XII.—*A sketch of the history of the fossils of the Indian Gondwána system.*—*By* Ottokar Feistmantel, M. D., *Palæontologist, Geological Survey of India.*

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In a late number of this Journal* Mr. Lydekker published a sketch of the history of the fossil Vertebrata of India, and it is my intention now to give a similar sketch of the fossils of the Gondwána system, for the same reasons as those which Mr. Lydekker indicated in the beginning of his paper.

Before proceeding to discuss the details it will be necessary to make a few general remarks upon the Gondwána system, its importance, extent and classification. By the name Gondwána system the Geological Survey now designates what was formerly known as the Plant-bearing series.

The title was proposed by Mr. H. B. Medlicott, about 9 years ago (1872), but was not then admitted into publicity though more or less current on the Survey; since 1876 it has come into general use in print also.†

This system of sedimentary rocks is the most important in the peninsula, for two reasons, first because it is prominently fossiliferous and secondly because it includes the rich coal deposits for which India is so famous.

As regards the distribution of these rocks, I refer to my paper in the Records of the Geological Survey of India, just quoted, as well as to the Manual of the Geology of India, 1879 (Vol. I, and map), from which the following may be extracted:‡

From Raniganj§ these deposits stretch in detached basins up the Damuda valley,‖ into the highlands of Chutia Nágpur.¶ To the north of this area smaller patches also occur, as especially the Rájmahál area,** the Deogarh coalfields†† and the Karharbári coalfield.‡‡

* J. A. S. B., Vol. XLIX, Pt. II, 1880.

† Feistmantel: Notes on the age of some fossil Floras in India; R. G. S. Ind. Vol. IX, p. 28, 1886.

‡ I refer here to the distribution, because when quoting the fossils I shall have ample opportunity to mention the various deposits.

§ This shall be hereafter always mentioned as Raniganj coalfield.

‖ Here we have in a consecutive order from E. to W. the Jharia coalfield, the Bokharo and Ramgurh and the Káranpúra coalfields.

¶ Of these I shall have opportunity to mention the Aurunga coalfield (Palamow)

** Rájmahál hills.

†† Or Kuraun coalfield near Khurmatar, E. I. R.

‡‡ In Hazáribágh district, near Giridhi station.

From Chutia Nágpur these rocks stretch into the valley of the Sone, constituting the great South Rewah basin. By a narrow band of the topmost group passing by Jabalpur, this area is connected with the large basin in the Sátpura range* on the west side of which the stratified series passes under the trap rocks of the Deccan. Some few inliers have also been detected beneath the trap further to the west in the Narbada valley.

Far to the west, plant-bearing rocks of the Gondwána system (the Umia group) have long been known to exist in Cutch (Kach), while recently rocks of the same age were discovered in the peninsula of Kathiawár by Mr. Fedden.†

This northern main area of the Gondwána deposits has two southern extensions. The South-Rewah basin continues through Sirguja‡ into the Raigarh and Hingir coalfields, S. W. Bengal, towards the Talchir coalfield (Orissa) and the Athgarh§ area below Cuttack (Katák).

From the Sátpura basin in a southern direction we meet with rocks of this system in the neighbourhood of Nágpur,‖ whence they extend into the valleys of the Wardah¶ and Godavari rivers,** down to Rajamahendri.

From the Delta of the Godávari detached patches of these rocks occur also along the coast of the Carnatic (Karnatik) to Trichinopoli.†† All these deposits are within the peninsular area of India.

Only a small portion are found in the extra-peninsular area, *i. e.*, along the base of the Eastern Himálayas, in Sikkim and Upper Assam.

The proper knowledge of this system is almost entirely due to the labours and exertions of the officers of the Geological Survey, as the number of writers, unconnected with the Survey, who have worked at either the geology or palæontology, or contributed to the collections is but a limited one. To these latter I shall refer at first. In 1828 A. Brongniart described in his "Histoire des végétaux fossiles," two species of *Glossopteris*, this was the earliest mention of this interesting genus. Professor Göppert in his "Systema filicum fossilium 1836," also described *Glossopteris*. Professor Royle in his Illustrations of the Botany &c., Himalayan Mountains, 1839, established four species from the coal-bearing rocks of the Raniganj coalfield, all four of more or less interest. Professor Morris in

* Quoted hereafter always as Sátpura basin.

† Feistmantel, Records G. S. India, Vol. XIII, p. 1, pp. 62-64.

‡ The Ramkola-Tatapáni coalfields.

§ Atgarh sandstone.

‖ Nágpur area.

¶ Wardha valley coalfield (Upper Godávari basin.)

** Middle and lower Godávari basin.

†† Here we have the South Kistna district (Vemáveram) the Sripermatur area (near Madras) and the Trichinopoli plantbeds (Utatúr plantbeds).

1840 described in Capt. Grant's paper on the geology of Cutch* some plant-remains from beds, which are at present known to be the highest of the Jurassic rocks in Cutch (Kach). Among these were two species of *Ptilophyllum*, a fossil very characteristic of the upper groups of the Gondwána system. The animal fossils were described by Sowerby, some of which, as was shown later, came also from the highest Jurassic beds. An addition to these latter was made by Capt. W. Smee.† In a paper on recent and fossil cycadeæ 1841‡ Professor Morris again describes the two species of *Ptilophyllum* from India. In Professor Ungers' " Genera et species plantarum fossilium" (1850) we also find all the species of Indian Gondwána plants, known up to that date, although some of them were differently classed. In 1850 appeared also Dr. McClelland's Report on the Geological Survey of India, 1848-49; as it, however, was not published under the present arrangement of the Geological Survey, I quote it amongst these papers. It contains figures of plants from the upper and the lower (coal-bearing) groups of the Gondwána system, amongst the latter, several forms of great interest (as ascertained later by the originals) but the drawings are so utterly wrong, that the figures are of absolutely no use for those who cannot compare the originals. The most interesting fossil was the *Zamia burdwanensis*, which from the original specimen proved to be really a *Zamieae* of the *Pterophyllum*-tribe.

Sir P. Egerton described in 1851§ a fossil fish (*Lepidotus*) from the tableland of the Deccan, in the Peninsula of India collected by Col. Sykes, to which in 1853 another species was added by Mr. Bell|| and in 1857 two species again by Sir P. Egerton.¶

Of much greater importance were the labours of the late Rev. Mr. Hislop, in the Gondwána rocks of the vicinity of Nágpur. He collected first the very interesting *Ceratodus* teeth, which were afterwards described by the late Dr. Oldham,** he collected a reptilian skull near Mángli, south of Nágpur, which was described by Professor Owen as *Brachyops laticeps*,†† and he also collected numerous fossil plants near Nágpur, (Kámthi), Bhárat-wáda, Silewára and Mángli, which were described by Sir Charles Bunbury in 1861.‡‡ Of the many papers by Mr. Hislop I need only mention those

* Transact. Geol. Soc. Lond. Ser. 2, Vol. V.
† Transact. Geol. Soc. Lond. Vol. V, 2d. Ser.
‡ Ann. and Mag. Nat. H. Vol. VII, p. 110.
§ Qu. J. Geol. Soc. London, Vol. VII, p. 272, pl. XV.
|| Qu. J. Geol. Soc. London, Vol. IX, p. 351.
¶ Ibidem, Vol. X, p. 371.
** Mem. Geol. Surv. of India, Vol. I, 296, et seq. Plates.
†† Qu. J. G. Soc. Lond. Vol. XI, p. 37, Pl. II.
‡‡ Ibidem Vol. XVII, p. 325, seq. Pls. VIII-XII.

on the age of the coal strata in Western Bengal and Central India ;* on the geology and fossils of the neighbourhood of Nágpur,† which he wrote together with Mr. Hunter ; that on the connection of the Umrét coalbeds with the plantbeds of Nágpur,‡ and that on the age of the fossiliferous, thin-bedded sandstones and coal of the province of Nágpur in India,§ which was followed by a supplemental note in 1862.

In a paper by Baron de Zigno, entitled " Observations on the Flora of the Oolites,"|| he also makes general remarks on the Indian fossil Floras placing them all with the Oolite formation.

In the Proceedings of the Austrian Geological Institute (Verhandlungen der k. k. Geologischen Reichsanstalt) for the year 1861-62, there is a note upon the first 35 plates of the Rájmahál plants, which states, that the figures of *Zamites*, *Pterophyllum*, *Pecopteris*, *Taeniopteris* etc., agree with Austrian Keuper plants.

In another paper entitled " Sopra depositi di piante fossili del America settentrionale delle Inde e dell Australia, etc." 1862, Baron de Zigno has attributed a liassic age to the flora of the Rájmahál group.

In the same year (1862) Professor R. Jones published his Monograph of fossil Estheriae¶ wherein also the *Estheriae* of the Indian Gondwána system are described, especially *E. mangaliensis*, Jon., which is so abundant in the Mángli shales.

Here I have also to mention Professor Morris as co-author of a work on the Rájmahál Flora (1862) for although it was published in the Palæontologia Indica, he was not connected with the Geological Survey.

In 1864 a reptilian fossil, said to belong to the genus *Archegosaurus* was collected by Major Gowan near Bijori in the Sátpura basin.**

Ettingshausen in his great work on the comparison of living with fossil ferns,†† classes our *Taeniopteris lata* and *T. morrisi* (now *Macrotaeniopteris*) from the Rájmahál group, with *Acrostichum*, and writes of that formation as being liassic.

I should also refer here to Professor Huxley's paper " on the vertebrate fossils from the Panchet rocks near Raniganj, Bengal,‡‡ for although the

* J. As. Soc. Bengal, 1855, Vol. XXIV, p. 347.

† Qu. J. Geol. Soc. London, Vol. XI, with map.

‡ Ibid. Geol. Soc. London, Vol. XI, p. 555.

§ Ibid. Vol. XVII, p. 346 ; supplm. note, in Vol. XVIII, p. 36.

|| Ibid. Vol. XVI, p. 110.

¶ Palæontographical Society, 1862. An abstract of the same is in Qu. J. G. Soc. London, Vol. XIX, p. 140 &c.

** J. A S. B. XXXIII, 1864, pp. 336, 442.

†† Die Farrenkräuter der Jetztwelt &c., Wien. 1865.

‡‡ Pal. Indica, Ser. IV. 1. 1865.

specimens were collected by officers of the Geological Survey and were described in the Palæontologia Indica, yet the paper is by an author unconnected with the Survey.

In a later paper on *Hyperodapedon** Professor Huxley also refers to the same genus in India where it occurs in beds together with the before mentioned *Ceratodus;* in a further paper on the classification of the *Dinosauria*, with observations on the Dinosauria of the Trias,† he also discusses (p. 48), the Indian *Dinosauria*, and in a still more recent paper on *Stagonolepis Robertsoni* and on the evolution of *Crocodilia*‡ he mentions the Indian *Parasuchus* stating that it is very close to *Belodon*.

In Professor Schimper's "Traité de Paléont. végétale," 1869-1874, most of the fossil plants, known up to that date from the Gondwána system, are also quoted, but those of the Rájmahál and Damuda series are wrongly classed as being of the same (oolitic) age.

Sir Philip Egerton and Professor Miall, have recently (1878) examined, the former the ganoid fishes from the Deccan and the latter the *Ceratodus* teeth from Malédi and the results are published in the Palæontologia Indica, Ser. IV, 2, 1878.

These are about the most important papers wherein plants or animals of the Gondwána system have been referred to or described by authors who were not connected with the Geological Survey.

Quite recently we have a paper by Dr. W. Saise on "the Kurhurbali coalfield."

Those who have contributed to the collections of the Survey, are not numerous. The first is the late Rev. Mr. Hislop, who contributed fossil fish and plants; and I have especially to mention the contributions in recent times of Mr. J. I. Whitty, C. E., late Superintendent, Kurhurbali (Karharbári) collieries, Giridhi, Mr. W. G. Olpherts, C. E., the present manager, and Mr. N. Miller, inspector of the collieries at the same place.

If only some of the other managers and inspectors of collieries in India or others who have an opportunity of doing so, would pay a little attention to the fossil remains contained in the rocks accompanying the coal-seams, many an interesting specimen might be procured. But as the matter now stands the greatest portion of the collection of fossils from this system has been brought together by the officers of the Survey, to whom also the knowledge of the numerous deposits of this system is solely due.

* Qu. J. G. Soc. London, Vol. XXV, p. 138, &c.

† Qu. J. G. Soc. London, Vol. XXVI, pp. 32, et seq. 1870.

‡ Ibid. Vol. XXXI, p. 423, &c.

Most of them who have visited areas where rocks belonging to the system occur, have collected fossils and contributed papers towards the knowledge of its geology, others again towards that of its palæontology. As the respective papers are chiefly contained in the publications of the Geological Survey, it is sufficient to refer to these without enumerating the papers in detail. They are contained in the Records and Memoirs of the Geological Survey as well as in some of the volumes of the Palæontologia Indica. I may especially mention the papers of Mr. W. T. Blanford (in Memoirs and Records), W. Theobald (Memoirs and Records), Thomas Oldham (Memoirs, Records and Palæontologia) J. G. Medlicott (Memoirs), T. W. H. Hughes (Memoirs and Records), H. B. Medlicott (Records and Memoirs) V. Ball (Memoirs and Records) A. B. Wynne (Memoirs and Records) W. King (Records and Memoirs) R. B. Foote (Memoirs and Records) F. R. Mallet (Memoirs) C. L. Griesbach (Memoirs). I have myself contributed papers on Gondwána fossils to the Records and to the Palæontologia Indica and Mr. Lydekker has described some of the vertebrate animals of this system, also in Records and Palæontologia Indica.

A detailed account of the various features of this system, as known up to 1879, is to be found in the Manual of Geology of India, to which I particularly refer. Of papers referring to the Gondwána system, published by officers of the Geological Survey elsewhere than in the Survey publications, I have especially to mention Mr. V. Ball's "Jungle life" 1879, and his paper "On the coalfields and coal production of India" 1879.* I have already contributed a paper on Raniganj plants to the Society's Journal in 1876† and Mr. R. Lydekker, as mentioned above, published in the same Journal a Sketch of the history of the fossil Vertebrata of India where also the Vertebrate fossils of the Gondwána system (*Pisces, Batrachia* and *Reptilia*) are referred to.

I have to mention at last, that some officers of the survey collected fossils in various districts, though they have not published papers on the same, thus Mr. V. Ball collected largely in the Raniganj field (Raniganj and Panchet groups) also in the Sátpura basin; Mr. F. Fedden near Nágpur, Isapur, south of Chanda (Wardha valley coalfield), in Kathiawár and in Kach, and Mr. C. A. Hacket in the Sátpura and South Rewah basins.

I shall now make a few remarks on the stratigraphical divisions, as I shall have to refer to them, when enumerating hereafter the plants.

We have at first divisions into "upper" and "lower" portions of the Gondwána system; but here it must be remembered that this classification is not to be taken in the rigid sense, which formerly used to be the case with

* Scientific Proceedings of the Royal Dublin Society, 21st April 1879.

† Vol. XLV. Based upon a collection of plants made by Mr. J. Wood-Mason.

reference to the Mahádeva and Damuda series; for we know now that one (and probably two) of the most characteristic plants of the "lower" Gondwána portion *i. e.*, *Glossopteris* passes freely into the "upper" portion, so that from this point of view there is a passage from the "lower" into the "upper" which view is also borne out in several basins by the geological relations. On the other hand, however, it is only fair to state, that the most characteristic plant of the "upper" Gondwánas, *i. e.*, the small cycadaceous plant *Ptilophyllum*, has not hitherto been observed in any bed of the "lower" Gondwánas.

Within these two broad divisions of the Gondwána system minor groups have been distinguished in the various basins of the system, of which a synopsis may be thus represented.

A. *Upper portion of the Gondwána system.*

Jabalpur division.*
- Umia group = Tripetty sandstones.
- Chikiala sandstones.
- Jabalpur group.
- Bagra group.

Intermediate groups.*
- Kota-Maléri beds = Denwa group.
- ? Chari group.
- Ragavapuram = Vemáveram =
- Sripermatúr = Utatúr plantbeds.

Rájmahál division.*
- Rájmahál group = Athgarh sandstones =
- Budawáda group = Sironcha sandstone =
- Pachmari sandstone = Dubrájpur group.

B. *Lower portion of the Gondwána system.*

a. Panchet division.† Panchet group and = Almod beds.

b. Damuda division.†
- Mángli shales, Kámthi and Raniganj group and Bijori horizon.
- Iron shales (Motur horizon.)
- Barákar group.

c. Talchir division.†
- Karharbári beds—
- Talchir shales—
- Boulder bed

} Talchir group.

* These three divisions are proposed by myself.

† These three divisions were introduced by Mr. W. T. Blanford, 1878.

With regard to the fossil contents of these several groups, I have to make the following remarks:

a. Jabalpur division.

Umia group.—A name proposed by Dr. Stoliczka, for the uppermost Jurassic beds in Kach. It contains marine animals, plants (*Ptilophyllum*); a jaw of *Plesiosaurus* (*indicus*) was also found.

Recently Mr. Fedden recognised the same group in Kathiawár, although it shows there a somewhat closer relation to the next group.

Marine representatives of it are the Tripetty sandstones of Mr. W. King; and the Chikiala sandstones (unfossiliferous) of the Upper Godávari basin (C. Pr.) are probably representatives of these latter.

Jabalpur group.—1871. Oldham, Geology of the Central Provinces, Rec. Geol. Survey of India, Vol. IV, p. 75.

The uppermost group of the Gondwána system in the South Rewah and Sátpura basin, called so from the town of Jabalpur, the terminus of the East Indian Railway. It contains plant-remains only. In South Rewah it contains some species which afterwards become very numerous in the next lower group (*Sripermatur*, *Vemáveram*), and in shales from the Sher river, Sátpura basin, specimens of *Glossopteris*, a lower Gondwána fossil, were identified.

Bágra group.—1872, H. B. Medlicott: Notes on the Sátpura Basin, Mem. G. S. I. Vol. X, pp. 133, 150.

No fossils have been found hitherto in this group; and no representatives of it have been met with elsewhere; called so from fort Bagra on the G. I. P. Railway.

b. Intermediate Groups.

Kota-Maléri group.—1876, Hughes: Rec. G. S. I. Vol. IX, Pt. 3.

1877, Hughes: The Wardha valley coalfield, Mem. G. S. I. Vol. XIII, Pt. 1, p. 81.

1877, W. King, Rec. G. S. I. Vol. X, Pt. 2, p. 58.

This group (composed of two horizons) contains interesting terrestrial and freshwater fossils (reptiles and fishes). The red clays at Maléri (with reptiles and Ceratodus teeth) are, however, considered lower than the limestones of Kota (with ganoid fishes). The group takes its name from the localities Kota (near Sironcha, Cent. Prov.) and Maléri middle Godávari basin, south of Chanda.

The plant-beds of Chirakunt, (middle Godávari basin, Cent. Prov.), are on the same horizon and these plants are of the same character as those of some other groups to be mentioned presently.

This group has hitherto been only known from the C. Provinces (upper and middle Godávari basin), till quite recently, when, Mr. Hughes discovered

representatives of the Maléri clays in the South Rewah basin (near Tiki, 81° 25′ long. ; 23° 56′ lat.), with the same reptiles, but without *Ceratodus.*

The Denwa group of the Sátpura basin* appears to be a representative of the (Kota) Maléri group ; a *Parasuchian*† scute was procured from the same.

There are several other groups which have probably to be placed on the same horizon, which I shall also quote under special headings.

Chari group.—Another group, the third from above, of the Kach Jura, proposed by Dr. Stoliczka. Vertebrae of a *Parasuchian* crocodile‡ were found, which tend to correlate this group with the Denwa group.

Sripermatúr group.—1873, Foote, Geology of Madras, Mem. G. S. I. Vol. X,p. 63, et seq.

A group of rocks in the neighbourhood of Madras, which contains marine animals and plants. By its fossil remains this group is correlated with the Vemáveram shales§ (Vemáveram, 12 miles north north-east of Ongole, S. Kistna country), the Utatúr plant beds‖ (Utatúr, Trichinopoly district) and the Ragavapuram shales¶ (Ragavapuram 27 miles north-east of Ellore and West of Rajamahendry, Lower Godávari.) With these latter the plant beds of Chirakunt (see ante) have to be correlated and from the geological position of these two latter groups, one must also judge of that of the others. They are all, I think somewhat higher than the Rájmahál group proper.

c. Rájmahál Division.

*Rájmahál group*** (in the restricted sense).

1877, V. Ball, Geology of the Rájmahál hills, Mem. G. S. I. Vol. XIII, p. 55, (209).

This is the lowest group of the fossiliferous beds of the Upper Gondwánas. It is developed typically in the Rájmahál hills, where it is highly fossiliferous, containing a rich and varied Flora.††

The sandstones of Golapili (near Ellore,) South Godávari district‡‡ are true representatives of the typical Rájmahál group. They contain a Flora only.

* H. B. Medlicott, Mem. G. S. I. Vol. X.

† Lydekker, Pal. Indica, Ser. IV, 2, p. 30, Pl. VI, fig. 8.

‡ Lydekker, ibid. p. 31.

§ 1879, Foote, Mem. G. S. I. Vol. XVI, pt. 1, pp. 60, 66.

‖ 1873, Foote, Mem. G. S. I. Vol. X, p. 63, and 1878, Rec. G. S. I. Vol. XI, p. 258.

¶ 1879, Foote, Mem. G. S. I. Vol. XVI, pt. 1, p. 76.

** This group is not to be mistaken for "Rájmahál Series" which included several groups and was almost tantamount with what now is known as Upper Gondwánas minus the Mahádevas, then considered distinct.

†† Palæontol. ind., Ser. II, 1862-1877 Gondwána flora, Vol. I, 1880.

‡‡ 1874, King Rec. G. S. I. Vol. VII, p. 159 ; Gondw. Flora, Vol. I.

The Athgarh sandstone (near Katák in Orissa) also represents the Rájmahál group.

On about the same horizon the following have most probably to be placed:

The "Pachmari sandstones,"* base of the Mahádeva in the Sátpura basin without fossils; the "Dubrajpúr group"† of the Rájmahál hills, which so far as is known with certainty, contains the genus *Ptilophyllum* only; the Sironcha sandstones,‡ near Anáram, on the Pranhita river, Central Provinces, with fragmentary plant remains (conifers); and lastly, from its geological position (below the Vemáveram shales), the Budaváda group,§ is probably also to be classed here although containing plants and marine animals.

Certain red shales on the Northern face of the Latiahar hill, in the Aurunga coalfield, and containing Lower Gondawána fossils (*Glossopteris, Vertebraria* &c.,) should most probably be included here also.

a. Panchet Division.

Panchet group.—1861, Blanford (W. T.) Report on the Raniganj coalfield Mem. G. S. I. Vol. III, p. 126.

The uppermost group of the Lower Gondwánas is typically developed in the Raniganj coalfield, from whence it was first described. It is here fossiliferous, containing *Labyrinthodontia* and *Dicynodontia* and plants. It has its name from the Panchet hill, Bengal

This group is also developed in several other basins but is scarcely fossiliferous; and the Almod beds (H. B. Medlicott) in the Sátpura basin are representatives of this group.

b. Damuda Division.

Raniganj group.—1861, W. T. Blanford, M. G. S. I. Vol. III.

Top-group of the Damuda series, highly fossiliferous and coal-bearing.

At first described from the Raniganj coalfield, where it is typically developed.

It was afterwards recognised in all the Damuda valley coal-basins, but also beyond this region it is developed; in the Aurunga coalfield, Ramkola and Tatapáni coalfields and quite typically also in the South Rewah basin.

* H. B. Medlicott, Mem. G. S. I. Vol. X, p. 155.

† V. Ball, ib. Vol. XIII, Pt. 2, p. 44, etc.

‡ 1877 King, Rec. G. S. I. Vol. X, Pt. 2, p. 56, et seq.

§ Foote, Mem. G. S. I. Vol. XVI, Pt. 1, pp. 69-71.

It is represented by some other groups in other coalfields, *viz.*, the Kámthi group* of the Nágpur area and of the Raigarh-Hingir coalfields,† and the Bijori horizon of the Sátpura basin,‡; both are fossiliferous.

The Mángli shales of the Cent. Provinces, (South of Nágpur) are also placed here although I was (and I must say, I am still so) very much inclined to believe them to be more closely related to the Panchet group.

Ironstone shales.—1861, W. T. Blanford. On the Geology etc., of the Raniganj coalfield, Mem. G. S. I. Vol. III, p. 28.

This group, from a stratigraphical point of view belongs to the Raniganj group, though on account of the occurrence of ironstone it is easily separable. It is present in most of the Bengal coal-fields and both the ironstones as well as the carbonaceous shales in which they are imbedded, or with which they alternate, are fossiliferous, the fossils being very much the same as in the other groups of the Damuda division.

The Motúr horizon§ of the Sátpura basin is most probably the representative of the ironstone shales.

Barákar group.—1861 Oldham (T.) Additional remarks on the geology, relations etc., of the rocks in Bengal etc., M. G. S. I. Vol. III, p. 42.

For the lowest group of the Damuda division (series), which was at first simply called "lower Damudas," the above name was proposed by Dr. Oldham (1861), since the corresponding term "upper Damudas," had also to be replaced by another name (the present Jabalpur group) as it was employed for a group of the upper Gondwána portion.

The Barákar group, like the Raniganj group, is rich in coal, and is present in most of the coalfields; it contains also numerous fossils, which, however, on the whole do not differ much from those of the two higher groups.

c. Talchir Division.

Karharbari beds (coalbearing.)—1877, Feistmantel, Rec. G. S. I. Vol. X, Pt. 3, p. 137-139.

1878, W. T. Blanford, Rec. G S. I, Vol. XI, Pt. 1.

The coalbeds of the Karharbári coalfield were formerly included in the Barákar group; but the examination of the Flora has shewn their closer connexion with the Talchirs. They are with certainty known from the above coalfield and from the Mopáni coalfield, Sátpura basin.

* 1870, W. T. Blanford, Rec. G. S. I. Vol. IV, p 50; Mem. G. S. Ind. Vol. IX, p. 11, et seq.

† V Ball, Rec. G. S. India, Vol. VIII, p. 113, etc.

‡ H. B. Medlicott, Mem. G. S. I. Vol. X, p. 27.

§ H. B. Medlicott, Mem. G. S. I. Vol. X, p. 29, (161.)

In these beds *Vertebraria* appears for the first time, *Glossopteris* is largely enough developed, *Gangamopteris* predominates.

Talchir group.—1859. Talchir coalfield, M. G. S. I. Vol. I.

This peculiar group which is at the base of the whole Gondwána system is met with in all the various basins. It consists of shales (bluish grey or olive green, fine earthy), sandstones and a boulder bed, which is believed to have been formed by floating ice. The shales are fossiliferous; fossils are known hitherto from three basins, in two of which I have collected and found the fossils to be numerous.

Here *Glossopteris* takes its origin in India; among other fossils the genus *Gangamopteris* is the most numerous. There is also a fragment of an insect wing, but too fragmentary to allow of an identification or classification.

I shall now proceed to enumerate the Gondwána fossils hitherto known, from the entire system, in systematic (biological) order giving with each genus and species its distribution. I begin with the lowest plants passing then to the animals. Of references to the species I shall give only such where there is a figure of the species or the latest description. I have also added, for sake of convenience, the etymological derivation of all the names.

PLANTAE.

Class: ALGAE.*

Genus *Chondrites*,† Stbg.

There is only one Alge mentioned from the Gondwána system, and even its occurrence is very doubtful.

Chondrites (?), dichotomus, Morr. sp.

1840. *Fucoides*, Morris, Transact. Geol. Soc. Lond. Vol. V, 2 Ser. Tab. XXI, fig. 1.

1876. *Chondrites*, Feistmantel, Kach Flora, Gondwána Flora. Vol. II, p. 6.

Group and locality uncertain, as is the species itself.

Class: EQUISETACEÆ.‡

This order is well represented, though almost entirely in the Lower Gondwánas.

* The seaweed family.

† From Chondrus, name of a living genus of seaweeds.

‡ Horse-tail family.

Genus *Equisetum*, Lin.

The stem articulated, the internodes striated, the leaves connected to a sheath, placed round the joints.

Only one species from the Upper Gondwánas.

Equisetum rajmahalense,* Oldh. and Morr. sp. (Schimp.)

1862. *Equisetites*, Oldham and Morris, Rájmahál Flora (Gondwána Flora, Vol. I,) Pl. II, figs. 2-5, Pl. XXXV, figs. 3, 4.

1877. Feistmantel, Rájmahál Flora, Gondwána Flora, Vol. I, p. 63.

Resembles *Equisetum münsteri*, Schimp.

Rájmahál group : Belátikur near Burio, Rájmahál hills.

Genus *Schizoneura*,† Schimp. et Moug. 1844.

This genus occurs in Europe in Triassic and rhaetic beds only.

Schizoneura gondwanensis,‡ Fstm.

1876. Feistmantel, Rec. G. S. I. Vol. IX, p. 69.

1880. Pal. indica, Gondwána Flora, Vol. III, p. 61, Pls. I A.—IX. A.

The stem articulated, striated and branched ; the leaflets about 12-22, long and with a middle vein, are joined into a sheath which splits into two or more portions, placed round the joint.

Differs from the European form by the greater number and the somewhat coarser consistence of the leaflets.

Range :—

Upper Gondwánas : Certain red shales of apparently Lower Mahádeva (lower Upper Gondwánas) age, on north face of Latiahar hill, (close to the top) Aurunga coalfield.

Lower Gondwánas : Panchet group : near Maitúr, north-west of Assensole, Raniganj coalfield.

Raniganj group : Raniganj and Jharia coalfields ; Hurdeeamo, N. W. of Sarum, Bokaro coalfield ; Ramkola coalfield ; Garjan hills, Raigarh coalfield ; South Rewah basin (several places) ; Baricondam, Sátpura basin.

Barákar group : Lumki hill, Karharbári coalfield.

Karharbári beds : ? Karharbári coalfield ; Mohpáni coalfield (Sátpura basin).

* Rájmahál hills.

† Schizo (gr) = to slit ; neura (gr) = the vein.

‡ Called so from the Gondwána system.

Schizoneura comp. *meriani*,* Schimp.

1879. Feistmantel, Pal. ind., Talchir-Karharbári flora, Pl. I, figs. 6-7.
1880. Damuda-Panchet flora, ibid. p. 64, Pl. VIII A. 4; IX A. 3-6.

Some specimens from the Karharbári and Raniganj coalfield appear to belong to this species.

Some other equisetaceous stalks from the Talchir shales appear also to belong to *Schizoneura*, so that in India this genus ranges from the Talchir to the Panchet groups.

Genus *Phyllotheca*,† Bgt.

A genus at first described from the upper coalmeasures in Australia (*Ph. australis*, McCoy) then from the Italian Oolite (by Zigno), then from India and lately from the Siberian Jura.

Phyllotheca indica,‡ Bunb.

1862. Bunbury, Nágpur plants, Qu. J. G. S. Vol. XVII, p. 355, Pls. X, XI.
1880. Feistmantel, Pal. ind., Gondwána Flora, Vol. III, p. 67, Pl. XII A fig. 3-9.

Lower Gondwánas: Raniganj (*Kámthi*) *group:* Raniganj coalfield and Nágpur area.

Phyllotheca robusta,§ Feistm.

1880. Pal. ind., Gondwána Flora, Vol. III, pp. 68-69, Pl. XIV A, figs. 1-2.

Lower Gondwánas: Raniganj group (?) near Dubrajpur, Gopicándar area, Rájmahál hills.

Another *Phyllotheca* was recently brought by myself from the Talchir shales, Káranpúra coalfield, but it is not yet figured.

Genus *Trizygia*,‖ Royle.

Like *Sphenophyllum* of the palaeozoic period, but the leaves in *three* pairs on one side of the articulation, always *six* leaves only.

Trizygia speciosa,¶ Royle.

1839. Royle, Botany etc., Himalayan Mts. p. 431, Pl. II, fig. 8.
1876. Feistmantel, J. A. S. Beng., Vol. XLV, p. 342, Pl. XV, fig. 1-2.

a. Lower Gondwánas: Barákar group in the Bokáro coalfield (near Layo); Aurunga coalfield (near Murup) and in the Talchir coalfield (near Gopálprasád).

* Proper name.
† Phyllon (gr) = a leaf; theca (gr) = a sheath.
‡ Indicus (lat) = indian.
§ Robustus (lat) = strong.
‖ Threis (gr) = three; Zeugos (gr) = a pair.
¶ Speciosus (lat) = handsome.

b. Raniganj group: Raniganj coalfield; Sátpura basin; Sikkim (according to Sir J. D. Hooker).

Genus *Vertebraria*,* Royle.

A very peculiar genus, hitherto with certainty known only from India and Australia.

Vertebraria indica, Royle.

1839. Royle, *l. c.*, p. XXIX, Pl. II, fig. 1-7.
1880. Feistmantel, Pal. ind. Gondwána Flora, Vol. III.

This fossil is very abundant and has a very wide distribution.

Upper Gondwánas: In the red shales, mentioned above, from the Latiahar hill, Auranga coalfield.

Lower Gondwánas: Raniganj (Kámthi) group in most of the coalfields.

Barákar group: in most of the coalfields.

Karharbári beds: Karharbári coalfield, rare.

Class FILICES.

Ferns are very numerous both in the upper and lower portion of the Gondwána system.

Order Gleicheniaceæ.

Several forms, described at first with other generic names, appear to belong here.

Gleichenia† *bindrabunensis*,‡ Schimp.

1862. *Pecopt. gleichenioides*, Old. and Morr. Rájmahál flora, Pal. ind., Gondwána Flora, Vol. I, pp. 45, 46, Pls. XXV, XXVI, fig. 1, 3.
1869. Schimper, Trait. d. Pal. vég. I, p. 670.

Upper Gondwánas: Rájmahál group in the Rájmahál hills.

Pecopteris§ *tenera*,‖ Feistm.

1876. Feistmantel, Kach Flora, Pal. ind., Gondwána Flora, Vol. II, p. 26, Pl. III, fig. 5.

Upper Gondwánas: Umia group, Dudye in Kach.

Order Marattiaceæ.

Genus *Danaeopsis*,¶ Heer.

Danaeopsis rajmahalensis,** Feistm.

1877. Feistmantel, Pal. ind., Gondwána Flora, Vol. I, p. 105, Pl. XXXVIII, fig. 4

* Vertebra (lat) = a joint of the back-bone.
† A living genus.
‡ From Bindrabun.
§ Peko (gr) = to comb; pteris (gr) = fern.
‖ Tener (lat) = tender.
¶ Like Danaea.
** Rájmahál hills.

Upper Gondwánas: Rájmahál group in the Rájmahál hills.

Another *Danaeopsis* will be described by myself on the next opportunity from the S. Rewah basin.

Order Cyatheaceæ

Genus *Cyathea*,* Lin.

Cyathea comp. *Tchihatcheffi*†, Schmalh.

1880. Feistmantel, Pal. ind., Gondwána Flora, Vol. III, p. 75, Pl. XVI, A. figs. 1, 2, 4.

Lower Gondwánas: Barákar group, near Talchir, Talchir coalfield.

This species is otherwise known from the Jura of the Altai Mountains.

Sphenopteris‡ *polymorpha*,§ Fstm.

1876. Journ. As. Soc. Beng., Vol. XLV, pp. 356-358, Pl. XVI, figs. 5-7, XVII.

1880. Pal. ind., Gondw. Flora, Vol. III, p. 76, Pls. XV A, XVI A, fig. 3, XVI A *bis*, figs. 1-6.

Lower Gondwánas: a. Barákar group: Lumki hill, Karharbári coalfield.

b. Raniganj group: Raniganj coalfield.

Genus *Dicksonia*,‖ L'Hérit.

In this genus have, I think, to be placed besides others, also several forms which were formerly classed with other genera.

Dicksonia hughesi,¶ Fstm.

1880. Pal. indica, Gondwána Flora, Vol. III, p. 52.

Lower Gondwánas: Raniganj group of the Jharia coalfield, and of the Sátpura basin (Bijori horizon).

Dicksonia bindrabunensis,** Feistm.

1877. Feistmantel, Rájmahál Flora, Gondwána Flora, Vol. I, p. 76, Pl. XXXVII fig. 2.

Upper Gondwánas: Rájmahál group, at Bindrabun, Rájmahál hills.

Other ferns, from the upper Gondwána portion, to be placed with this genus, are: *Dicksonia*†† sp. (Jabalpur group), *Sphenopteris*, comp. *arguta*,‡‡

* A living genus.
† Proper name.
‡ Shen (gr) = wedge; pteris (gr) = fern.
§ Polys (gr) = many-fold; morphe (gr) = form, aspect.
‖ A living genus; from a proper name.
¶ Proper name (Mr. Th. Hughes).
** Name of a locality.
†† 1877. Pal. ind. Gondwána Flora, Vol. II, p. 86.
‡‡ 1877. Pal. ind. Gondwána Flora, Vol. I, pp. 71-72.

Lindl. and Hutt., (Katrol group, Jabalpúr group and Rájmahál group), and *Hymenophyllites bunburyanus*,* Oldh. and Morr. sp. (Rájmahál group). Of more importance is the following.

Pecopteris lobata, Oldh. and Morr.

1877. Pal. Gondwána Flora Vol. I, p. 92.
1881. Rec. Geol. Survey India, Vols. XIV, p. 149, figures.

This species I have quite recently united with *Dicksonia* also.

Upper Gondwánas: Rájmahál group in the Rájmahál hills.

Order Polypodiaceae.

Type *Asplenium*, Lin.

Asplenium whitbyense, Heer.

1876-79. Pal. ind. Gondwána Flora, Vols. I and II.
1880. Pal. ind. Gondw. Flora, Vol. III, p. 52.

This species was at first described as an *Alethopteris*, but the discovery of specimens with fructification, caused it to be placed with *Asplenium*.

Upper Gondwánas: Umia group, Katrol group (Kach.); *Jabalpur group* (Sátpura and S. Rewah basin); *Sripermatur* (*Vemáveram*) group.

Lower Gondwánas: Raniganj group, Raniganj coalfield; Jharia coalfield; S. Rewah basin. To this very probably also belongs:

Alethopteris† *indica*, Oldh. and Morris.

1862-79. Pal. ind. Gondwána Flora Vol. I.

Upper Gondwánas: Jabalpur group (S. Rewah basin); *Sripermatur group* (Sripermatur area; S. Kistna area; Utatúr plant beds); *Rájmahál group.*

Alethopteris medlicottiana,‡ Feistm.

1877. Pal. ind. Gondwána Flora, Vol. IX, p. 87.

This form has probably also to be classed with this group.

Upper Gondwánas: Jabalpur group (Sátpura aud S. Rewah basin).

Type *Polypodium*, Linn.

Alethopteris lindleyana,§ Royle.

1869. Royle, *l. c.*, Tab. II, fig. 4.

Although the appearance of the fronds would place this form in proximity with *Aspl. whitbyense* and *Aspl. indicum*, yet, fructificating specimens,

* 1877. Pal. ind. ib. p. 88.
† Alethes (gr) = true, and pteris = true fern.
‡ Proper name.
§ Proper name.

which I believe belong to this species force us to class it with *Polypodium*, keeping it still with the *Polypodiaceae*.

Lower Gondwánas: Raniganj group, Raniganj coalfield.

Type *Phegopteris*, Mett.

With the *Polypodiaccae* has also to be placed *Alethopteris phegopteroides*,* Feistm.

1876. Journ. As. Soc. Beng., Vol. XLV, p. 362, Pl. XVIII.

A very large and interesting fern, of rare occurrence.

Lower Gondwánas: Raniganj group, Raniganj coalfield.

The ferns, hitherto named, are such, as can with some certainty (mostly from the state of the fructification) be correlated with living ferns. There is, however, a by far greater portion of ferns which have to be classed under separate orders whose relation to living forms can only be guessed, while in some other cases it is entirely doubtful.

Order Sphenopterideae.

Sphenopteris hislopi,† Oldh. and Morr.

1862. Rájmahál Flora, Pal. ind., Gondwána Flora, Vol. I, Pl. XXXI, figs. 1-5.

Upper Gondwána: Rájmahál group, near Bindrabun, Rájmahál hills.

Sphenopteris? membranosa,‡ Feistm.

1877. Rájmahál Flora, Pal. ind., Gondwána Flora, Vol. I, p. 81, Pl. XXXII, fig. 4.

Upper Gondwánas: Rájmahál group, near Burio, Rájmahál hills.

Order Neuropterideae§ and Cardiopterideae.‖

Genus *Cyclopteris*,¶ Bgt.

Cyclopteris oldhami,** Feistm.

1877. Rájmahál Flora, Pal. ind. Gondwána Flora, Vol. I, p. 88, Pl. XXXVI, figs. 1, 2, XXXVII, 5, 6.

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills.

* Like Phegopteris, a living genus of ferns.
† Proper name.
‡ Thin membranaceous.
§ From Neuropteris (neuron = the vein, and pteris = the fern) = the vein fern.
‖ Kardia (gr) = the heart and pteris ; the heart fern.
¶ Kyklos (gr) = circle and pteris.
** Proper name.

Neuropteris valida,* Feistm.

1879. Talchir—Karharbári Flora, Pal. ind., Gondwána Flora, Vol. III, (Ser. XII, 1) pp. 10-11, Pls. II-VI.

A large and exceedingly nice, single pinnate fern, very numerous at one locality.

Lower Gondwánas: Karharbári beds at Buriadi (very frequent), at Passerabhia and Domahni (rare) in the Karharbári coalfield.

Cyclopteris (?) pachyrhachis,† Gopp.

1841. Göppert, Genera plant foss. Nos. 5-6, p. 94, Pl. 4, 5.

Lower Gondwánas: Panchet group, N. W. of Assensole, Raniganj coalfield.

Order Alethopterideae and Pecopterideae.
(Incertae sedis).

Alethopteris lobifolia,‡ Lindl. and Hutt.

1877. Feistmantel, Jabalpur Flora, Pal. ind., Gondwána Flora, Vol. II, p. 86, Pl. III, fig. 1.

A species of the English Oolite.

Upper Gondwánas: Jabalpur group, from the Sher river, Sátpura basin.

Pecopteris concinna,§ Presl.

1838. Presl. in Sternberg, V. d. Fl. d. Vorw. II, p. 149, Pl. 41, fig. 3.

Lower Gondwánas: Panchet group, N. W. of Assensole, Raniganj coalfield.

Genus *Merianopteris*,|| Heer.

Established by Prof. Heer in his "Fossil Flora der Schweiz,"¶ upon the former *Pecopteris angusta* from the Trias.

From India I have identified one species of somewhat larger dimensions as:

Merianopteris major,** Feistm.

1880. Damuda Flora, Pal. ind., Gondwána Flora, Vol. III, p. 52.

Lower Gondwánas: Raniganj group, in the Raniganj coalfield.

* Validus (lat) = strong, big.
† Pachys (gr) = thick; rhachis (gr) = stalk.
‡ With lobed leaves.
§ Concinnus (lat.) = pretty, neat.
|| Merian's fern.
¶ Pflanzen der Trias, pp. 69, 87-88; Pls. XXIV, 7-12; XXXVII, XXXVIII, 7, 8.
** Larger, in comparison with the original species.

*Asplenites** (*Lepidopteris*) *macrocarpus*,† Oldh. and Morr.

1862. Oldham and Morris, Rájmahál Flora, Pal. ind., in Gondwána Flora, Vol. I, p. 51, Pl. XXVIII, 2, 3, XXXVI, 5-7.

1877. Feistmantel, Rájmahál Flora, Gondwána Flora, Vol. I, p. 171, Pl. XXXVII, figs. 3, *a*, *b*, *c*, 4, 4*a*; XLVIII, figs. 2.

Resembles very much the Rhœtic *Lepidopteris ottonis*, Schenk sp.

Upper Gondwánas: Rájmahál group, near Bindrabun, in the Rájmahál hills; in the Atgarh sandstone, near Katák; and near Golapili, on the Southern Godávari.

Pecopteris reversa,‡ Feistm.

1879. Pal. ind. (II-4), Gondwána Flora, Vol. I, p. 205, Pl. I, fig. 5, II. 1, 2, 7.

Upper Gondwánas: Sripermatur group, near Ragavapuram, on the S. Godávari, and in the Sripermatur area.

Order Lomatopterideæ and Pachypterideæ.

Genus *Thinnfeldia*, Braun.

Thinnfeldia§ comp. *odontopteroides*,‖ Feistm. (Morr. sp.)

1845. Morris in Strzelecki, N. S. Wales, etc.

1879. Feistmantel, Flora des östl. Australiens, *Palæontographica*, Suppl. III, Lief. III, pp. 105, 165.

This is a species, occurring in Australia in beds, above the upper coal-measures, *viz.*, Hawkesbury-Wianamatta, and in the upper mesozoic beds of Queensland and Tasmania.

Lower Gondwánas: Panchet group in the Ramkola Tatapáni coal-fields.

Upper Gondwánas; Parsora near Beli, South Rewah basin (lowest upper Gondwána beds).

Thinnfeldia indica,¶ Feistm.

1877. Feistmantel, Rájmahál Flora, Pal. ind., Gondwána Flora, Vol. I, p. 87 Pl. XXXIX, 1. 1*a*; a true *Thinnfeldia*.

Upper Gondwánas: Rájmahál group Busko Ghat and Burio, Rájmahál hills.

* Like *Asplenium*, in fossil state.
† Makros (gr) = large; karpos (gr) = fruit.
‡ Reversed.
§ Proper name.
‖ Like *Odontopteris*.
¶ Indian.

Thinnfeldia subtrigona,* Feistm.

1879. Pal. ind., Gondwána Flora, Vol. I, p. 203, Pl. I, fig. 7.

Upper Gondwánas: Sripermatur group near Vemáveram, S. Kistna country.

There are several other fragmentary specimens, which I have also referred to *Thinnfeldia*, but which need not be repeated here.

Genus *Dichopteris*,† Bgt.

Dichopteris ellorensis, Feistm.

1879. Pal. ind., Gondwána Flora, Vol. I, p. 204, Pl. II, figs. 8-10.

Upper Gondwánas: Sripermatur group, at Ragavapuram, Ellore District, S. Godávari.

Genus *Pachypteris*,‡ Bgt.

Pachypteris specifica,§ Feistm.

1876. Feistmantel, Kach Flora, Pal. ind., Gondwána Flora, Vol. II, p. 32, Pl. III, fig. 6.

Upper Gondwánas: Umia group, near Bhujuri in Kach.

Another species was described by me from Kach, which is somewhat doubtful.

Order Taeniopterideæ.

Genus *Taeniopteris*,|| Bgt.

Taeniopteris densinervis,¶ Feistm.

1876. Feistmantel, Kach Flora, Pal. ind., Gondwána Flora, Vol. II, p. 19, Pl. II, fig. 6.

I could not assign this fragmentary specimen to any of the subgenera of *Taeniopteris*.

Upper Gondwánas: Umia group, near Kukurbit, in Kach.

Sub-genus *Macrotaeniopteris*,** Schimp.

This comprises all the large and broad-leaved forms, in Europe it belongs principally to the mesozoic epoch. In India it occurs both in the Lower and Upper Gondwánas.

* Somewhat trigonal.

† Dicha = in two; pteris = fern; the forked fern.

‡ Pachys (gr) = thick, coarse; pteris = fern.

§ Typical.

|| The ribbon fern.

¶ Densus = close; nervus = the vein.

** Makros (gr) = large and *taeniopteris*.

*Macrotaeniopteris crassinervis,** Feistm.

1877. Feistmantel, Rájmahál Flora, Pal. ind., Gondwána Flora, Vol. I, p. 102, Pl. XXXVIII, figs. 1-3.

Upper Gondwánas: Rájmahál group, near Murero and Busko-ghát, Rájmahál hills.

Macrotaeniopteris lata,† Oldh. and Morr.

1862. Rájmahál Flora; Pal. ind., Gondwána Flora, Vol. I, p. 41, Pls. I, II, fig. 1; III. fig. 2, Pl. V.

1877. Feistmantel, ibidem, p. 99, Pl. XLIII, fig. 1.

Upper Gondwánas: Rájmahál group, near Bindrabun in the Rájmahál hills. Numerous.

Macrotaeniopteris morrisi,‡ Oldh.

1862. Oldham *l. c.*, p. 13, Pl. III, fig. 1.

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills.

Macrotaeniopteris ovata,§ Schimper.

1862. Oldham *l. c.*, p. 43, Pl. III, figs. 3-5.

1877. Feistmantel, *l c.*, p. 103, Pl. XXXVII, fig. 1.

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills.

Macrotaeniopteris danaeoides,‖ Royle sp.

1839. Royle, Botany etc., Himalayan Mts. Pl. II.

1876. Feistmantel, J. A. Soc. Bengal, Vol. XLV, p. 365, Pl. XIX, figs. 1, 2, Pl. XX, fig. 1.

Lower Gondwánas: a. Barákar group, near Burgo in the Rájmahál hills.

b. Raniganj (Kámthi) group of the Raniganj and Jharia coalfield, Bengal; near Kámthi, Nágpur area.

Macrotaeniopteris feddeni,¶ Feistm.

1876. Feistmantel, R. G. S. I. Vol. IX, Pt. 4, p. 137.

Lower Gondwánas: Kámthi (Raniganj) group, near Kámthi, Nágpur area.

There is another fragment of a *Macrotaeniopteris* from the Jabalpur group, but I do not find it practicable, to distinguish it by a separate name.

* Crassus = thick, nervus = vein.

† Latus = broad.

‡ Proper name.

§ Oval.

‖ Like *Danaea*, a living genus of ferns.

¶ Proper name (Mr. F. Fedden, of the Geolog. Survey of India.)

Sub-genus *Oleandridium*,* Schimp.

Oleandridium vittatum,† Bgt. sp. (Schimp).

1828. *Taeniopteris*, Brongniart hist. d. végét. p. 263, Tab. 82, figs. 1-3.

1876. *Oleandridium*, Feistmantel, Kach Flora, Pal. ind., Gondwána Flora, Vol. II, p. 15, Pl. I, figs. 1-3, II, 1-5, XII. 1.

Upper Gondwánas : Umia group, near Kukurbit in Kach.

Oleandridium comp. *stenoneuron*,‡ Schenk.

1867. Schenk, Flora der Grenzschichten p. 103, tab. XXV, figs. 5, 6.

Lower Gondwánas : Panchet group, in the Raniganj coalfield.

Sub-genus *Angiopteridium*,§ Schimp.

Angiopteridium spathulatum,‖ Schimp. (McClell. sp.).

1862. *Stangerites*, Oldham and Morris, Rájmahál Flora, Pal. ind., Gondwána Flora. Vol I, Pl. VI, figs. 1-7.

1877. Feistmantel, Rájmahál Flora, ib. Vol. I, p. 97.

This is a very common species in the *Upper Gondwánas : a. Rájmahál group*, in the Rájmahál hills and near Golapili, South Godávari district *b. Sripermatúr group* in the S. Godávari district, S. Kistna and Trichinopoli district, as also in the middle Godávari basin.

Angiopteridium mc'Clellandi,¶ Schimp. (Oldh. and Morr. sp.)

1862. *Stangerites*, Oldham and Morris, *l. c.*, p. 33, Pl. XXIII.

1877. Feistmantel, *l. c.*, Pl. XLVI, figs. 5, 6.

This is a species with a pinnate frond.

Upper Gondwánas : a Rájmahál group in the Rájmahál hills; *b. Sripermatúr group* in the S. Godávari and S. Kistna district, and in the Sripermatúr area.

Lower Gondwánas : There are some fragmentary specimens from the "Lower Gondwánas" in the Nágpur area and in the South Rewah basin, which, although not exhibiting the pinnate nature of the frond yet exhibit all the other characters of the species to such a degree, that I cannot distinguish them.

Angiopteridium ensis,** Oldh. sp.

1862. *Stangerites*, Oldham and Morris, *l. c.*, p. 35, Pl. VI, figs. 8-10.

1877. Feistmantel, ibid. p. 97.

* Like *Oleandra*, a living genus.

† Vittatus, from vitta = a headband.

‡ Stenos = close; neuron = the vein.

‖ Like *Angiopteris*, a living genus.

§ Spathulate.

¶ Proper name.

** Ensis (lat) = sword—referring to the form of the leaf.

Upper Gondwánas: Rájmahál group, near Burio, Rájmahál hills.

Angiopteridium comp *ensis*, Oldh. sp.

1877. Feistmantel, Golapili Flora *l. c.*, p. 173, Pl. I, figs. 6*a*, 7*a*.

Upper Gondwánas: Rájmahál group, near Golapili, S. Godávari district.

Angiopteridium infarctum, Feistm.

1880. Feistmantel, Pal. ind., Gondwána Flora, Vol. III, p. 53.

Lower Gondwánas; Barákar group, near Kumerdhubi, Raniganj coalfield.

Type *Vittaria*, Swartz.

Genus *Paloeovittaria*,* Feistm.

Palaeovittaria Kurzi,† Feistm.

1876. Feistmantel, Raniganj plants, J. As. S. B., Vol. XLV, p. 368, Pl. XIX. fig. 3-4.

Lower Gondwánas: Raniganj group, Raniganj coalfield.

Order Dictyotaeniopterideæ.‡

This order might with equal propriety be termed *Glossopterides*, the only genus it at present comprises being the famous *Glossopteris*,§ Bgt.

Genus *Glossopteris*, Bgt.

1828. Brongniart, Histoire, végétaux fossiles, p. 223.

This genus is formed of leaves of generally a more or less oblong or spatulate shape of various sizes, with a *distinct midrib*, and the secondary veins forming a net-venation of a varied character.

It was at first described by Brongniart from Australia (from the upper coalmeasures) and from India, from beds, which are now known as the Raniganj group (see *ante*). Subsequently it was also identified from the lower coalmeasures (carboniferous) in N. S. Wales; it was found in India both in the *Lower* (in all groups) and *Upper* Gondwána system, so that it ranges in these two countries from Carboniferous to Jura.

In India it is very well represented, its greatest development being in the Lower Gondwána system, and in it in the *upper groups*. About 17 or 18 species are described in my Damuda Flora (Pal. ind., Gondwána Flora, Vol. III). For an easier arrangement I have grouped them into five *sections*, according to the net-venation and the shape of the leaf.

Of these species I shall mention here only those originally described by Brongniart and those which have a wide range in India.

* Palaios (gr) = old, ancient; and Vittaria = a living genus of ferns.

† Proper name = the late Curator, Botanical Gardens, Calcutta.

‡ *Taeniopterides* with a net-venation.

§ Glossa (gr) = tongue; pteris = fern.

*Glossopteris indica,** Schimp.

1828. Glossopt. browniana, var. indica, Brongniart Hist. vég. foss. p. 223, tab. 62, fig. 2, β

Lower Gondwánas: Barákar group, Raniganj group and *Panchet group.*

Upper Gondwánas: From the red shales, north face of Latiahar hill, Aurunga coalfield.

Glossopteris communis,† Feistm.

1876. Feistmantel, J. As. Soc. B., Vol. XLV, p. 375, Pl. XX, fig. 5.

Lower Gondwánas: Karharbári beds; Barákar group; Ironstone shales; Raniganj group; Panchet group.

Upper Gondwánas: The red shales, north face, Latiahar hill, Aurunga coalfield; *Jabalpúr group,* Sher river, Sátpura basin.

Glossopteris damudica,‡ Feistm.

1880. Pal ind. Gondwána Flora, Vol. III, p. 53.

Lower Gondwánas: Karharbári beds; Barákar group; Ironstone shales; Raniganj group.

Upper Gondwánas: Red shales, north face Latiahar hill, Aurunga coalfield.

Glossopteris browniana,§ Bgt.

1828. Brongniart, *l. c.*, p. 223, Pl. 62, fig. 1.

Lower Gondwánas: Barákar group; Raniganj group.

Glossopteris angustifolia,‖ Bgt.

1828. Brongniart, *l. c.*, p 227, Pl. 63, fig. 1.

1876. Feistmantel, J. As. Soc. B., *l. c.*, Pl. XXI, fig. 2-4.

Lower Gondwánas: Barákar group; Raniganj group; Panchet group.

The names of the others may just be mentioned:—

Gloss. intermittens, Feistm. (Barákar group); *Gl. stricta,* Bunb. (Kámthi-Raniganj group); *Glossopteris (?) musaefolia,* Bunb. (ditto); *Gl. retifera,* Feistm. (Raniganj group); *Gl. conspicua,* Feistm. (ditto). *Glossopt. divergens,* Feistm. (ditto); *Gl. ingens,* Feistm. (Barákar group); *Gl. leptoneura,* Bunb. (Kámthi-Raniganj group); *Gl. formosa,* Feistm. (Raniganj group); *Gl. orbicularis,* Feistm. (ditto); *Gl. decipiens,* Feistm. (Karharbári beds).

I may also mention that *Glossopteris* is now also known with certainty from the Talchir shales; I have brought several specimens from the Talchirs in the Chano vicinity, North Káranpúra coalfield.

* Indian.

† Common.

‡ Appertaining to the Damuda series.

§ Proper name.

‖ Narrow-leaved.

Order Dictyopterideæ.

The most prominent group of fossils in this order belong to a genus equally well represented in India and in Australia (Victoria) in beds of about the same horizon.

Genus *Gangamopteris*,* McCoy.

1875. McCoy Prodr. Pal. Victoria, Dec. II, p. 11.

Like *Glossopteris*, this genus is composed of leaves with a net-venation but *without* a midrib, all the veins radiating from the base into the leaf.

It is of frequent occurrence in the Lower Gondwánas in India but in a reversed proportion to *Glossopteris*, being most frequent in the lowest groups (Talchir-Karharbári) of that portion.

We know the following species:

Gangamopteris cyclopteroides,† Feistm.

1879. Feistmantel, Pal. ind., Gondwána Flora, Vol. III, Pt. 1, p. 12, Pls. VII, IX, XI, etc.

A very abundant species.

Lower Gondwánas: Talchir shales of the Karaun (Deoghur) and Káranpúra coalfields; *Karharbári beds* of the Karharbári and Mohpáni coalfield.

Of this species I have also described many varieties, occurring in one or the other of the above groups or both; but it is not necessary to repeat them here.

Gangamopteris buriadica,‡ Feistm.

1879. Feistmantel, *l. c.*, p. 15, Pl. XVIII, fig. 1-2.

Lower Gondwánas: Karharbári beds, Karharbári coalfield.

Gangamopteris major,§ Feistm.

1879. Feistmantel, *l. c.*, p. 15, Pl. XIV, 3, Pl. XVI, fig. 1-2.

Lower Gondwánas: Karharbári beds, Karharbári coalfield.

Gangamopteris angustifolia,‖ McCoy.

1879. Feistmantel, *l. c.*, p, 16, Pl. IX, fig. 5.

Lower Gondwánas: a. Talchir shales, in the Deoghur and Káranpúra coalfields; *b. Karharbári beds*, in the Karharbári coalfield.

This species also occurs in Australia in the upper coalmeasures (N. Castle-beds) and in the Bacchus-Marsh sandstone, Victoria.

* Gangamon (gr) = a small net; pteris = a fern.
† Like *Cyclopteris*.
‡ From the locality Buriadi, Karharbári coalfield.
§ Larger.
‖ Narrow-leaved

Among the specimens, lately brought by myself from the Karharbári and Káranpúra coalfields, there is also another species which occurs in the Bacchus-Marsh sandstone of Victoria.

Gangamopteris is also represented in the higher groups of the Lower Gondwánas.

*Gangamopteris anthrophyoides,** Feistm.

1880. Feistmantel, Pal. ind. Gondwána Flora, Vol. III, p. 54.

Lower Gondwánas: Raniganj group, Raniganj field.

Gangamopteris hughesi,† Feistm.

1876. Feistmantel, Rec. Geol. Survey of Ind. Vol. IX, Pt. 4, p. 38.

Lower Gondwánas: Kámthi (Raniganj) group, Kámthi, Nágpur area

Gangamopteris whittiana,‡ Feistm.

1876. Feistmantel, J. As. S. Beng., Vol. XLV, p. 371, Pl. XX, figs. 3-4.

Lower Gondwánas: Raniganj group, Raniganj coalfield.

Genus *Belemnopteris,§* Feistm.

1876. Feistmantel, J. As. Soc. Beng., Vol. XLV, p. 370.

Belemnopteris wood-masoniana,|| Feistm.

1876. Feistmantel, *l. c.*, p. 371, Pl. XX, figs. 1-2.

This is one of the most interesting fossils, being very close to some living forms, amongst others to *Hemionitis cordata*, Roxburgh, which grows in India.

Lower Gondwánas: Raniganj group, Raniganj field.

INCERTÆ SEDIS.

The systematic positions of some other ferns are not quite certain. Amongst them are several forms with a net-venation and with a compound leaf, as exhibited either by the actual attachment of several leaflets to a common stalk or by the shape of the leaflets.

I have classed them provisionally with *Sagenopteris*, but in case a new generic name should hereafter be required for them, I propose the name *Dactylopteris* (the fingered fern).

They are mostly from the *Raniganj group*. One species was also described by myself from the *Karharbári beds*.

* Like Anthrophyum, a living genus.
† Proper name.
‡ Proper name.
§ Belemnon (gr) = arrow-head; pteris = fern.
|| Proper name.

One leaflet is very similar to leaflets of *Sagenopteris rhoifolia*, Presl.

In this section (of uncertain ferns) also belongs that fern which I have already quoted elsewhere as *Actinopteris bengalensis*, and the shape of the leaves really resembles very much the form characteristic of this genus as described by Prof. Schenk from the Rhätic formation. Our fossil is from the *Raniganj group*.

Rhizomes and Stalks.

There are several indeterminable fossils which have to be considered as rhizomes and stalks of ferns. I shall refer to two only.

Genus *Rhizomopteris*,* Schimp.

Rhizomopteris balli,† Feistm.

1877. Rec. Geol. Survey, India, Vol. X, p. fig. 2-6.

This form is quite characteristic, exhibiting distinctly the circular scars and in some specimens also the dichotomy of the rhizome.

Upper Gondwánas; Athgarh sandstone (Rájmahál group) near Athgarh, Orissa.

Fern stem or *rhizome.*

1861. Bunbury, Sir. Ch. : Nágpur plants, Q. J. G. S. Vol. XVII, Pl. XII.

Lower Gondwánas: Shales at Mángli C. Prov., Wardha valley coalfield.

One or two specimens of a circinate vernation of a fern were also found in the Rájmahál group of the Rájmahál hills.

Class LYCOPODIACEÆ.‡

Remains of Lycopods are very rare in the Gondwána system. I can only record one species.

Genus *Lycopodites*,§ Sternb.

Lycopodites gracilis,‖ Feistm.

1880. Preface to Vol. II, Gondwána Flora, p. 19.

1881. Records Geol. Survey of India, Vol. XIV, Pt. 1, pp. 150-151, Pl. II, fig. 2.

This fossil was previously classed with the *Coniferae.*

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills.

Class CYCADEACEÆ.¶

Remains of cycadeaceous plants are very numerous, especially in the upper portion of the Gondwána system, although they are also sufficiently

* Rhizome of a fern.
† V. Ball, Geolog. Survey, India.
‡ The Club-moss family.
§ Fossil Club moss.
‖ Slender.
¶ Cycad family.

represented in the lower portion, and this by such typical forms, that no doubt can any longer exist as to the occurrence of *Cycadeaceæ* in the Lower Gondwánas.

Order Zamieae.

Genus *Pterophyllum*, Bgt.

This genus is very abundantly represented in the lower groups of the Upper Gondwánas, and so is the subgenus which we shall quote hereafter as *Anomozamites;* both these forms have their representatives also in the Lower Gondwánas.

Pterophyllum carterianum,* Old.

1862. Oldham and Morris, Rájmahál Flora, Pal. ind., Gondwána Flora, Vol. I, p. 22, Pls. XV, fig. 4, XVIII, fig. 1.

Upper Gondwánas: Rájmahál group near Bindrabun Rájmahál hills, and Golapili, South Godávari district.

Pterophyllum crassum,† Morr.

1862. Oldham and Morris, *l. c.*, p. 24, Pl. XVI, 2.

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills.

Pterophyllum footeanum,‡ Feistm.

1879. Feistmantal, Pal. ind. Gondwána Flora, Vol. I, p. 209, Pl. VI, figs. 1-6; VIII, XVI, 9.

Upper Gondwánas: Sripermatur group, at Vemávaram, South Kistna district, and in the Sripermatur area.

Pterophyllum kingianam,§ Feistm.

1877. Feistmantal, ib. p. 177, Pl. III; 1, IV, 1.

Upper Gondwánas: Rájmahál group, near Golapili, South Godávari district.

Pterophyllum medlicottianum,‖ Oldh.

1862. Oldham and Morris, *l. c.*, p. 21, Pl. XV, 3 XVII, 1.

1877. Feistmantel, *l. c.*, p. III, Pl. XLIII, fig. 2; XLIV, fig. 1.

Upper Gondwánas: Rájmahál group, near Bindrabun, Ghutiari and Murero in the Rájmahál hills.

Pterophyllum nerbuddaicum,¶ Feistm.

1877. Gondwána Flora, Vol. II, p. 94, Pl. VI, fig. 9.

* Proper name.

† Thick.

‡ Proper name (Br. Foote of the Geolog. Survey).

§ Proper name (W. King of the Geological Survey of India).

‖ Proper name (H. B. Medlicott, Superintendent, Geol. Survey of India).

¶ Nerbudda river.

Upper Gondwánas: Jabalpur group, on the Sher river, in the Sátpura basin.

This has been hitherto the only representative of *Pterophyllum* found in the upper groups of the Upper Gondwánas.

Pterophyllum propinquum,* Göpp.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 110, with figure in text.

Upper Gondwánas: Rájmahál group near Bindrabun, Rájmahál hills.

Pterophyllum rajmahalense,† Morr.

1862. Oldham and Morris, *l. c.*, p. 12, Pl. XIII, 3—5 Pl. XIV, Pl. XVIII, fig. 2.

Upper Gondwánas: Rájmahál group, near Bindrabun and Onthea, Rájmahál hills.

Pterophyllum burdwanense,‡ Feistm. (McClell. sp.).

1850. *Zamia burdwanensis*, McClelland, Report, Geol Survey of India, p. 53, Pl. XIX, fig. 4.

1877. *Pterophyllum*, Feistmantel, Rec. Geol. Survey of India, Vol. X, Pt. 2, p. 71, Pl. I, 1.

The cycadeaceous nature of this fossil, by the discovery in the collections of the original specimen, has been established beyond any doubt.

Lower Gondwánas: Raniganj group, Raniganj coalfield.

Subgenus *Anomozamites*,§ Schimp.

This subgenus comprises forms of *Pterophyllum* with unequal (irregular) leaflets (whence the name). Many of the Upper Gondwána *Pterophylla* have to be classed here.

Anomozamites fissus,‖ Feistm.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 61, Pl. XXXIX, figs. 2—4.

Upper Gondwánas: a. Rájmahál group near Burio, Rájmahál hills; *b. Vemáveram group*, at Vemáveram, South Kistna district.

Anomozamites jungens,¶ Feistm.

1879. Feistmantel, Pal. ind., Gondwána Flora, Vol. I, p. 208, Pl. VII, figs. 11—13.

Upper Gondwánas: Vemáveram group, at Vemáveram.

* Close.
† Appertaining to the Rájmahál hills.
‡ From the locality Burdwan.
§ Anomoios (gr.) = unlike, dissimilar.
‖ Fissus (lat.) = slit.
¶ Jungo (lat.) = to connect, to join.

Anomozamites lindleyanus,* Schimp.

1879. Feistmantel, ib., p. 208, p. Pl. XVI, fig 3.

Upper Gondwánas: Sripermatur (Vemáveram) group, in the Sripermatur area.

Anomozamites morrisianus,† Oldh. sp.

1862. *Pterophyllum*, Oldham and Morris, Rájmahál Flora, *l. c.*, p. 20, Pl. XV, 1, XVII, 2.

1877. Feistmantal, Rájmahál Flora, *l. c.*, p. 59, Pl. XLII, fig. 1.

Upper Gondwánas: Rájmahál group, near Bindrabun, Rájmahál hills and near Golapili, South Godávari district.

Anomozamites princeps,‡ Oldh. and Morr. sp.

1862. Oldham and Morris, ib. p. 23, Pl. X, 1—3; XI, 1; XII, 1; XIII, 1-2.

This is a very frequent species and one which attains very large dimensions.

Upper Gondwánas: Rájmahál group near Bindrabun, Rájmahál hills.

In connection with these species of *Anomozamites* in the "Upper Gondwánas," I have to mention that recently I have collected several specimens of an *Anomozamites* from "*Lower Gondwánas*" in the Aurunga coalfield, *viz.*, in the Barákar group; they will be described and illustrated on the next opportunity.

Genus *Zamites*, Bgt.

Zamites proximus,§ Feistm.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 63, Pl. XLI, fig. 1-2.

Upper Gondwánas: Rájmahál group near Murrero, Rájmahál hills.

Genus *Glossozamites*,|| Schimp.

Glossozamites stoliczkanus,¶ Feistm.

1879. Feistmantel, Talchir-Karharbari Flora, Pal. ind. Gondwána Flora, Vol. III, p. 19, Pl. XX, figs. 4-5.

Lower Gondwánas: Karharbári group, in the Karharbári, coalfield.

* Proper name (Lindley, the botanist).
† Proper name.
‡ Distinguished.
§ Very closely related.
|| Glossa (gr.) = tongue; and *zamites*.
¶ Proper name.

Genus *Podozamites*, F. Br.

This genus is represented here by detached leaflets only, which however are very numerous.

Podozamites lanceolatus,* Lindl. and Hutt.

1877. Feistmantel, Pal. ind., Gondwána Flora, Vol. II, p. 91, Pl. III, 7-14; IV, 1-10.

Very numerous in the

Upper Gondwánas: Jabalpur group on the Sher river, Sátpura basin, Bansa and Chandia South Rewah basin.

Podozamites lanceolatus, var. *spathulatus*.†

1877. Feistmantel, *l. c.*, p. 92, Pl, IV, 11-12.

Upper Gondwánas: Jabalpur group, Chandia, South Rewah basin.

Podozamites hacketi,‡ Feistm.

1877. Feistmantel, ib. p. 92, Pl. VII, 4-5.

Upper Gondwánas: Jabalpur group, on the Sher river Sátpura basin.

Podozamites comp. *lanceolatus*, Lindl. and Hutt.

1879. Feistmantel, Pal. ind.; Gondwána Flora, Vol. I, p. 210, Pl. IX, figs. 9-10.

Upper Gondwánas: Sripermatur (Vemáveram) group, at Vemáveram, South Kistna district.

With *Podozamites* of the upper Gondwánas a cycadeaceous fossil of the Lower Gondwánas, where it is very numerous, is in close relation.

Genus *Nöggerathiopsis*,§ Feistm.

1879. Feistmantel, Gondwána Flora, Vol. III, p. 23.

1881. Suppl. ib. pp. 55-59.

I have established this genus upon certain leaves, which were at first classed with *Nöggerathia;* but they do not belong to that genus, being more closely related to another (*Rhiptozamites*, Schmalh.) from the Siberian (Altai) Jura. The same genus also occurs in Australia, both in the lower (carboniferous) and upper (permian?) coalmeasures; in India it

* Lanceolate.

† Spatulate.

‡ Proper name.

§ Nöggerathia, the name of a fossil, and *opsis* (gr.) = appearance = a fossil with the appearance of Nöggerathia.

has a distribution through the entire lower Gondwánas, and passes also into the upper Gondwánas.

I think they all belong to one species.

Nöggerathiopsis hislopi,* Feistm.

1879. Feistmantel, *l. c.*, p. 23, Pl. XIX, 1-6; XX, 1; p. 58, Pl. XXVIII, 1-7; XXIX, 1-4; XXX, 5-9.

Spatulate leaves, of varying size, with numerous, straight, slightly radiating and several times forked veins. They are apparently the pinnulae of a pinnate leaf.

Lower Gondwánas: a. Talchir shales in the Deoghur (Karaun) and Káranpúra coalfield.

b. Karharbári beds, in the Karharbári and Mohpáni coalfield.

c. Barákur group in the Ramkola coalfield, at Barkoi in the Umrét coalfield, C. Prov.

d. Raniganj (Kámthi) group in the Raniganj coalfield, South Rewah basin, and in the Nágpur area.

Upper Gondwánas: From Parsora near Beli, South Rewah basin, in red shales, which are placed by Mr. Hughes in the upper Gondwánas.

A variety with a more rhomboidal leaf was distinguished by me as *Nögg. hislopi* var. *rhomboidalis* (*l. c.*, p. 24) from the Karharbári beds of of the Karharbári coalfield.

Genus *Ptilophyllum*,† Morr.

1837. Morris, in Grant's, Geol. of Cutch; Transact. Geol. Soc. Lond. 2nd ser. Vol. V, Pl. XXI.

This is a very common cycadeaceous plant in the upper Gondwánas.

Ptilophyllum acutifolium,‡ Morr.

1837. Morris, *l. c.*, Pl XXI, figs. 1-3.
1862. Oldham and Morris, Rájmahál Flora, *l. c.*, p. 19, Pls. XX—XXI, 2.
1876-79. Feistmantel, Gondwána Flora, Vols. I—II.

The largest form of the genus.

Upper Gondwánas: a. Umia group in Kach., *b. Jabalpur group*, Sátpura and South Rewah basin *c. Sripermatur group*, South Godávari and South Kistna district, Sripermatur area and Trichinopoly district, (Utatúr plant beds) and near Chirakunt middle Godávari; *d Rájmahál group* in the Rájmahál hills, and South Godávari.

* Proper name.
† Ptilon (gr.) = a feather; phyllum (gr.) = leaf.
‡ Acutus (lat.) = pointed, sharp; folium = leaf.

*Ptilophyllum cutchense,** Morr.

1837. Morris, ibid. *l. c.*, Pl. XXI, 4.
1862. Oldham and Morris, ib. *l. c.*, p. 30, Pl. XXI, 5-6, XXII.
1876. Feistmantel, Kach Flora, Gondwána Flora, Vol. II, Pl IV, fig. 6, 7; V, 1, 2*a*, 3; VII, 3, and other papers.

Upper Gondwánas: a. Umia group in Kach; *b. Jabalpur group* Sátpura and South Rewah basin; *c. Sripermatur group* South Kistna district and Sripermatur area. *d. Rájmahál group* in the Rájmahál hills and South Godávari district.

Ptilophyllum cutchense var. *minimum,*† Feistm.

1876. Feistmantel, Kach Flora; Gondwána Flora, Vol. II, p. 44, Pl. VII, fig. 1.

Upper Gondwánas: Umia group in Kach (near Kukurbit).

Ptilophyllum brachyphyllum,‡ Feistm.

1867. Feistmantel, Kach Flora, *l. c.*, p. 45, Pl. VII, 3.

Upper Gondwánas: Umia group Kach.

Ptilophyllum tenerrimum,§ Feistm.

1877. Feistmantel, Rájmahál Flora, in Gondwána Flora, Vol. I, p. 118.

Upper Gondwánas: Rájmahál group near Onthea, in the Rájmahál hills.

Genus *Otozamites,*|| F. Br.

Both basal angles of the leaflets are rounded. Numerous species are known from the Upper Gondwánas.

Otozamites acutifolius,¶ Feistm.

1879. Feistmantel, Pal. ind. Gondwána Flora, Vol. I, p. 212, Pl VIII, fig. 12.

Upper Gondwánas: Sripermatur group in the South Kistna district (Vemáveram).

*Otozamites abbreviatus,*** Feistm.

1862. *Palæozamia bengalensis*, Oldh. and Morr. *l. c.*, p. 27 Pl. XIX, 1, 2, 6.
1877. *Otozamites*, Feistmantel, Rájmahál Flora, *l. c.*, p. 68.

* Appertaining to Cutch (Kach).
† Very small.
‡ Short-leaved.
§ Very slender.
|| The eared Zamites.
¶ Sharp-leaved.
** Shortened.

Upper Gondwánas: a. Rájmahál group, at Surujbera, Rájmahál hills; *b. Sripermatur* group in the South Godávari district (Ragavapuram), South Kistna country (Vemáveram) and Sripermatur area.

Otozamites angustatus,* Feistm.

1877. Feistmantel, Jabalpur Flora, Pal., ind. Gondwána Flora, Vol. II, p. 93, Pl. VI, fig. 8, VII, 1.

Upper Gondwánas: Jabalpur group, on the Sher river, Sátpura basin.

Otozamites bengalensis,† Schimp.

1862. *Palæozamia brevifolia*, Oldh. and Morris, Rájmahál Flora, *l. c.*, p. 31, Pl. IX, 4-5.

1869. Schimper, Trait. d. Pal. véget. II, p. 172.

Upper Gondwánas: Rájmahál group, at Bindrabun, Rájmahál hills.

Otozamites (Cyclozamites) bunburyanus,‡ Feistm.

1879. Feistmantel, Gondwána Flora, Vol. I, p. 211; Pl. VII, fig. 5-8; XVI, 2.

Upper Gondwánas: Sripermatur group, at Vemáveram, South Kistna district; and the Sripermatur area.

Otozamites contiguus,§ Feistm.

1876. Feistmantel, Kach Flora, Gondwána Flora, Vol. II, p. 48, Pl. VII, fig. 4.

Upper Gondwánas: Umia group, in Kach, near Kukurbit.

Reminds of *Otozam. abbreviatus* of the Rájmahál group.

Otozamites distans,‖ Feistm.

1877. Feistmantel, Jabalpur Flora, Gondwána Flora, Vol. II, p. 93, Pl. VII, fig. 3.

Upper Gondwánas: Jabalpur group, on the Sher river, Sátpura basin.

Otozamites comp. *goldiaei*,¶ Bgt.

1876. Feistmantel, Kach Flora, p. 49, Pl. XI. 3-4.

Upper Gondwánas: Umia group, Kukurbit in Kach.

Otozamites gracilis,** Schimp.

1877. Feistmantel, Jabalpur Flora, *l. c.*, p. 93, Pl VI, figs. 5-7; VII, 2.

Upper Gondwánas: Jabalpur group on the Sher river, Sátpura basin.

* Narrow.
† Appertaining to Bengal.
‡ Proper name.
§ Contiguus (lat.) = being in contact.
‖ Apart.
¶ Proper name.
** Pretty.

*Otozamites hislopi,** Oldh. (Mss.)

1877. Feistmantel, Jabalpur Flora, *l. c.*, p. 92, Pl. VI, figs. 3-4; XI, 1.

Upper Gondwánas : a. Jabalpur group on the Sher river, Sátpura basin, *b. Sripermatur* group at Vemáveram, South Kistna district.

Otozamites imbricatus,† Feistm.

1876. Feistmantel, Kach Flora, *l. c.*, p. 48, Pl. VIII, fig. 1.

Upper Gondwánas : Umia group near Loharia in Kach.

Otozamites oldhami,‡ Feistm.

1862. *Palæoz. bengalensis* var. *obtusa,* Oldham and Morr. *l. c.*, p. 28, Tab. XIX. figs. 3-5.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 68.

Upper Gondwánas : Rájmahál group at Surujbera, Rájmahál hills.

Otozamites parallelus,§ Feistm.

1879. Feistmantel, Gondwána Flora, Vol. I, p. 212, Pl. VIII, 5.

Upper Gondwánas : Sripermatur group at Vemáveram, South Kistna district.

Otozamites rarinervis,‖ Feistm.

1879. Feistmantel, Gondwána, Vol. I, p. 211, Pl. VIII, figs. 8-11; IX, 6.

A small form with very few (3-4) veins in the leaflets.

Upper Gondwánas : Sripermatur group at Vemáveram, South Kistna district; in the Sripermatur area.

Genus *Dictyozamites,¶* Oldh.

A genus hitherto confined to India. Leaf very much resembling that of *Otozamites*, but the venation is a nice net-venation radiating from the point of insertion at the base. Only one species.

*Dictyozamites indicus,**** Feistm.

1862. *Dictyopteris,* Morris in Oldham and Morris, Rájmahál Flora, *l. c.*, p. 38, Pl. XXIV, 1, 2.

1877. Feistmantel, ib., *l. c.*, p. 70.

1879. Feistmantel, Madras coast Flora, Gondwána Flora, Vol. I, p. 214, Pl. III—V.

* Proper name.
† Imbricate.
‡ Proper name.
§ Parallel.
‖ Rarus = rare, scarce.
¶ Dictyon (gr.) = a small net.
** Indian.

Upper Gondwánas: *a. Rájmahál group* at Amrapara and Murero, Rájmahál hills, and at Golapili South Godávari district; *b. Sripermatur* group at Vemáveram, Annavalawarpalem, Budávada, Deronaḍula, Godlur section, Idupulapadu, Panur and Razpudi, South Kistna country; Alicur hills, Chumbrumbaucum, Nagari river, Sripermatur, Todukadu, Vellakoti section in the Sripermatur area; Marawatúr Trichinopoli district.

Its distribution thus follows a line in a North-East to South-West direction, beginning in the North-East, and running along the South-eastern coast down to Trichinopoli in the South-West.

Order Cycadeæ.

Genus *Cycadites*, Bgt.

Cycadites confertus,* Oldh. and Morr.

1862. Oldham and Morris, *l. c.*, p. 25, Pl. VII, 4; VIII, 2, and *C. blanfordianus*, ib. p. 16, Pl. IX, 2.

1876. Feistmantel, Rájmahál Flora, *l. c.*, p. 127, Pl. XLVIII, 1.

Upper Gondwánas: Rájmahál group, at Bindrabun, Rájmahál hills.

Cycadites constrictus,† Feistm.

1879. Feistmantel, Madras coast Flora, Gondwána Flora, Vol. I, p. 215, Pl. VII, fig. 10.

Upper Gondwánas: Sripermatur group, shales at Vamáveram, South Kistna district.

Cycadites cutchensis, Feistm.

1876. Feistmantel, Kach Flora, Gondwána Flora, Vol. II, p. 50, Pl. XI, fig. 1.

Upper Gondwánas: Umia group, near Kukurbit in Kach.

Cycadites rajmahalensis, Oldh.

1862. Oldham and Morris, *l. c.*, p. 15, Pl. VII, 42, VIII, 1.

Upper Gondwánas: near Bindrabun, Rájmahál hills.

Genus *Williamsonia*, Carr.

1868. Williamson, Transact. Linn. Soc., Vol. XXVI, p. 663, ff. Pl. 52, 53.

1868. Carruthers, ibid., pp. 691, et. f. seq.

Fruits and stems of this plant occurred in the Indian Upper Gondwánas.

* Very close, referring to the leaflets.

† Constrictus (lat.).

Williamsonia gigas,* Carr.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 75, Pl. XLIV, 2-4.

1862. Oldham and Morris, ib. *l. c.*, Pl. XXXII, 12, XXXIV, (stems) figures only, without description.

Upper Gondwánas: a. Rájmahál group near Bindrabun and Amrapara, Rájmahál hills; near Golapili, South Godávari district; *b. Jabalpur group* in the Sátpura basin.

Williamsonia blanfordi,† Feistm.

1876. Feistmantel, Kach Flora, *l. c.*, Pl. XII, figs. 5-7.

Upper Gondwánas: Umia group, near Kukurbit in Kach.

Williamsonia microps,‡ Feistm.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. 129, Pl. XLI, fig. 4, 5.

Upper Gondwánas: Rájmahál group, near Buskoghát, Rájmahal hills.

Only for the sake of reference I may mention that quite recently Nathorst (in Ofvers. af Kongl. Vetenskaps-Akademiens forhandlingar 1880 No. 9), tried to assign to *Williamsonia* a somewhat different systematical position; but as his view is based mostly on the same specimens from which Phillips, Carruthers and Williamson treated it as cycadeaceous, doubts may be entertained whether we should disbelieve these three authors until many more typical specimens have been procured. In India those forms, which I referred to *Williamsonia* occurred solely in association with *Cycadeaceæ*.

Squamæ cycadearum, (? Gymnospermarum).

Both in the Upper and Lower Gondwánas there occur certain scale-like leaflets, which appear to belong to similar forms known from elsewhere, and attributed to cycadeaceous or gymnospermous plants, as scales. Some of those from the Upper Gondwánas could even be classed with a genus from Europe, introduced by Count Saporta, while those of the Lower Gondwánas must be left only with the above general denomination.

Upper Gondwánas: a. Umia group near Bhujuri in Kach; *b. Sripermatur* group at Vemáveram South Kistna district, and at Chirakunt, middle Godávari, (Maleri beds), *c. Lower Mahádevas*, north face of Latiahar hill, Aurunga coalfield.

Lower Gondwánas: a. Barákar group in the Raniganj coalfield. *b. Raniganj group* in the Rájmahál and Raniganj coalfields.

Semina.

In the Rájmahál group (Upper Gondwánas) there occur small oblong ovate, slightly compressed seeds, which agree in form and structure with

* Gigas = gigantic. † Proper name. ‡ Of small appearance.

similar ones, described as belonging to cycadeaceous plants, with which I have thus classed them *(Cycadinocarpus)*.

Class CONIFERÆ.*

This large class of plants, so widely represented in present times, was also not uncommon amongst the Gondwána fossils, especially in the upper portion, and the *Gingko*-like forms are of special interest.

Order ABIETACEÆ.

Genus *Voltzia*,† Bgt.

Voltzia heterophylla,‡ Bgt.

1879. Feistmantel, Talchir-Karharbári Flora, Gondwána Flora, Vol. III, p. 25, Pl. XXII—XXIV, fig. 4; XXV.

Lower Gondwánas: *a. Karharbári beds*, Karharbári coalfield; *b. Raniganj group*, (?) South Rewah basin.

These are leaved and branched specimens.

But there is a scale-like impression, from the Raniganj group, of the Raniganj coalfield, which has great resemblance with similar scales, attributed to *Voltzia* as fruit scales.

Genus *Albertia*,§ Schimp.

Albertia sp. (comp speciosa, Schimp.)

1879. Feistmantel, ib., *l. c.*, p. 29, Pls. XXIV, 3; XXVI, 2 and ? XXIV, 1, 2.

Occurring together with *Voltzia* in Europe and India.

Lower Gondwánas: *Karharbári beds*, Karharbári coalfield.

Genus *Palissya*,|| Endl.

Palissya conferta,¶ (Oldh. sp.) Feistm.

1862. *Cunninghamites*, Oldham in Rájmahál Flora, *l. c.*, (no description), Pl. XXXII, figs. 9-10.

1877. Rájmahál Flora, *l. c.*, p. 183, Pl. XLV, 4-9, XLVIII, fig. 4.

Upper Gondwánas: *a. Rájmahál group* near Bindraban, Murero and Onthea, Rájmahál hills; Golapili South Godávari district and Sironcha sandstones near Anáram on the Pranhita river C. Pr.; *b. Sripermatur* group (and Maleri beds) in the Sripermatur area; at Chirakunt and Jangaon, middle Godávari, basin.

* Conebearing plants.
† Proper name (Voltz.).
‡ With leaves of two kinds.
§ Proper name (Albert).
|| Proper name (Palissy).
¶ Confertus = dense.

*Palissya indica,** Feistm. (Oldh. sp.).

1862. *Taxodites*, Oldham, *l. c.*, (no description), Pl. XXXIII, fig. 6.
1877. Feistmantel, *l. c.*, p. 84; XLV, 9.
1877. Jabalpur Flora, Gondwána Flora, Vol. II, p. 95, Pl. VIII, 1, 2, 4.

Resembling much *Palissya brauni*, Endl.

Upper Gondwánas: Was hitherto found in all the groups of the Upper Gondwánas, in Kach, in the Sátpura basin, South Kistna district, middle Godávari, Rájmahál hills, Athgarh sandstones near Cuttack and on the South Godávari.

Palissya indica, var. *laxa.*

1876. Feistmantel, Kach Flora, *l. c.*, p. 57, Pl. XII, fig. 8, 9.

Upper Gondwánas: Umia group, near Kukurbit in Kach.

Palissya jabalpurensis,† Feistm.

1877. Feistmantel, Jabalpur Flora, Gondwána Flora, Vol. II, p. 16, Pl. IX, fig. 1.

Upper Gondwánas: *a. Umia group* near Thann, North Kathiawár; *b. Jabalpur group*, Sátpura basin; *c. Sripermatur* group near Vamávaram South Kistna district, and at Naogaon, middle Godávari.

Genus *Cheirolepis,*‡ Schimp.

Cheirolepis comp. *münsteri,*§ Schimp.

1877. Feistmantel, Golapili Flora, Gondwána Flora, Vol. I, p. 185, Pl. VIII, fig. 8.

Upper Gondwánas: Rájmahál group, at Golapili, South Godávari district.

Genus *Araucarites*, Stbg.

Araucarites cutchensis,‖ Feistm.

1876. Feistmantel, Kach Flora, Gondwána Flora, Vol. II, p. 62, Pl. VII, 7, VIII, figs. 2-6, IX, 1-3; XII, 10.

1877. Jabalpur Flora, ib., p. 16, Pl. XIV.

Upper Gondwánas: a. Umia group in Kach and Kathiawár; *b. Jabalpur group* in the Sátpura and South Rewah basin; *c. Sripermatur* (Maleri) group middle Godávari (Naogaon), South Kistna district, Sripermatur area and Trichinopoli district.

Resembles very much *Arauc. brodiei* from the English Oolite.

* Indian.
† Jabalpur.
‡ Cheir (gr.) = hand; lepis (gr.) = scale, referring to the shape of the fruit scales.
§ Proper name.
‖ The Kach fossil Araucaria.

Araucarites macropterus,* Feistm.

1877. Feistmantel, Golapili Flora, *l. c.*, p. 186, Pl. VIII, figs. 9-11.

Upper Gondwánas: a. Rájmahál group at Golapili, South Godávari; *b. Sripermatur* group in the Sripermatur area.

Genus *Pachyphyllum*,† Sap. in Schimp.

Pachyphyllum (?) *divaricatum*,‡ Bunb. sp.

1876. Feistmantel, Kach Flora, *l. c.*, p. 59, Pl. X, fig. 1, 1*a*.

Upper Gondwánas; Umia group, Kukurbit in Kach.

Pachyphyllum heterophyllum,§ Feistm.

1879. Feistmantel, Madras-coast Flora, (Pal. ind.), Gondwána Flora, Vol. I, p. 219, Pl. XI, fig. 4, XVI, 16.

Upper Gondwánas; Sripermatur group, at Vemáveram, South Kistna country.

Pachyphyllum peregrinum,‖ Schimp.

1879. Feistmantel, Madras-coast Flora, *l. c.*, p. 218, Pl. XI, fig. 5; XII, 3, 9.

Upper Gondwánas; Sripermatur group, in the South Kistna district and Sripermatur area.

Order Taxodiaceæ.

Genus *Echinostrobus*,¶ Schimp.

Echinostrobus expansus,** Schimp sp.

1876. Feistmantel, Kach Flora, *l. c.*, Pl. IX, 6-9; X, fig. 3, 4.

1877. Jabalpur Flora, *l. c.*, p. 97, Pl. XIX, 4-5.

Upper Gondwánas: a. Sripermatur group, South Kistna district (Vemáveram); *b. Jabalpur group*, Sátpura and South Rewah basin; *c. Umia group*, Kach.

Echinostrobus rajmahalensis,†† Feistm.

1877. Feistmantel, Rájmahál Flora, *l. c.*, p. (90) 142, Pl. XLV, fig. 3.

Upper Gondwánas: a. Rájmahál group, Rájmahál hills, *b. Sripermatur* group, Sripermatur area.

* Makros (gr.) = large; pteron (gr) = the wing.
† Pachys (gr.) = thick; phyllum (gr.) = the leaf.
‡ Divaricatus (lat.) = spread.
§ With two kinds of leaves.
‖ Peregrinus (lat.) = strange, foreign.
¶ Echinus (lat.) = urchin, strobus (lat.) = the cone.
** Expanded, spread out.
†† Appertaining to the Rájmahál hills.

Echinostrobus rhombicas,* Feistm.

1877. Feistmantel, Jabalpur Flora, *l. c.*, p. 98, Pl. XI, figs. 6-11.
1879. Madras coast Flora, *l. c.*, p. 220, Pl. XII, fig. 10.

Upper Gondwánas ; a. Sripermatur group in the Sripermatur area ; *b. Jabalpur group* South Rewah basin.

Genus *Brachyphyllum*,† Bgt.

Brachyphyllum mammillare,‡ Lindl. and Hutt.

1877. Jabalpur Flora, *l. c.*, p. 96, Pl. X, fig. 12, XI, 2-3 ; XII ; XIII.

Upper Gondwánas : Jabalpur group, Sátpura and South Rewah basin.

Order Taxaceae.

Genus *Taxites*, Bgt.

Taxites planus,§ Feistm.

1879. Feistmantel, Madras coast Flora, *l. c.*, p. 221, Pl. XIII, 1, 2-8 ; XIV, 1, 2, 4, 5 ; XV, 2.

Upper Gondwánas : a. Sripermatur group, South Godávari district, South Kistna country and Sripermatur area ; *b. Jabalpur group* near Bansa in South Rewah.

Taxites tenerrimus,‖ Feistm.

1877. Feistmantel, Jabalpur Flora, *l. c.*, p. 98, Pl. VIII, 6-8 ; X, 5, 6-11.

Upper Gondwánas : a. Sripermatur group at Vamáveram, South Kistna district ; *b. Jabalpur group*, Sátpura and South Rewah basin ; *c. Umia group*, Than in North Kathiawár.

Family *Salisburieae.*

Genus *Gingko*, Thunb.

The discovery of this interesting genus in the Jurassic beds of India, adds greatly to its geographical distribution. We know two fossil species from India.

Gingko crassipes,¶ Feistm.

1877. Feistmantel, Rec. Geol. Survey of India, Vol. X, Pt. 4, p. 197, fig. 6, 7.
1879. Madras coast Flora, *l. c.*, p. 221, Pl. XV, figs. 6-9, XVI, 13.

Upper Gondwánas : Sripermatur group, South Godávari district and Sripermatur area.

* Rhombic.
† Brachys (gr.) = short, phyllum (gr.) = leaf.
‡ Mammillaris (lat.) = elevated.
§ Planus (lat.) = flat.
‖ Very tender.
¶ With a thick stalk.

Gingko lobata,* Feistm.

1877. Feistmantel, Record etc, *l. c.*, p. 187, fig. 4, 5.
1877. Jabalpur Flora, *l. c.*, p. 98, Pl. I, fig. 1.

Upper Gondwánas : Jabalpur group, Sher river, Sátpura basin, together with *Glossopteris*.

Genus *Euryphyllum*,† Feistm.

Euryphyllum whittianum,‡ Feistm.

1879. Feistmantel, Talchir Karharbári Flora, Gondwána Flora, Vol. III, p. 26, Pl. XXI, fig. 1.

Lower Gondwánas : Karharbári beds, Karharbári coalfield.

Genus *Rhipidopsis*,§ Schmalh.

Rhipidopsis densinervis,‖ Feistm.

1880. Feistmantel, Damuda, Panchet Flora, Gondwána Flora, Vol. III, p. 55.

Lower Gondwánas : Kámthi (Raniganj) group South Godávari district.

There is another species, from the Barákar group in the Aurunga coalfield, which closely resembles *Rhipidopsis gingkoides*, Schmalh., from the Petschora country, North Eastern Russia.

Incertæ sedis.

There are several other fossils, which apparently belong to the *Coniferae*, but the position of which is not quite certain.

Phœnicopsis,¶ Heer sp.

1877. Feistmantel, Jabalpur Flora, *l. c.*, p. 99.

Upper Gondwánas : Jabalpur group, Sher river, Sátpura basin.

Czekanowskia,** Heer sp.

1877. Feistmantel, *l. c.*, p. 99.

Upper Gondwánas : Jabalpur group near Jabalpur, Sátpura basin.

Seeds and Stems.

In the lower Gondwánas there occur certain seeds, most of them being winged, which from their analogy with similar seeds described from else-

* Lobed.
† Eurys (gr.) = broad.
‡ Proper name.
§ Rhipis (gr.) = a fan ; opsis (gr.) = appearance.
‖ Densus (latin) close ; nervus (lat.) = vein.
¶ Phönix = a palm, opsis appearance.
** Proper name.

where have to be classed as coniferous seeds; they remind mostly of *Samaropsis*, specimens of which were figured by Heer from the Jura of E. Siberia and the Amur countries and by Prof. Schmalhausen from the Altai, Tunguska river, and the Petschora country.

From the shales at Mángli (C. Prov.) and from the iron shales of the Raniganj coalfield, there are known fragments of stems, which appear to be also of coniferous plants, but they are at present of very little importance, being very fragmentary.

I have thought it more practical and more true to nature to treat of the plant remains in a systematical (biological) order from the whole Gondwána system together, not grouping them according to the divisions of "Lower" and "Upper Gondwánas," as it is now known that this system also geologically forms a continuous series, and from this point of view it is then also easier to form an adequate idea, as to the *Homotaxis* of the system, especially if we consider that most of the plants formerly considered characteristic of the lower Gondwánas freely pass into the "upper portion," as can be gathered from the foregoing pages.

ANIMALIA.

Animal remains as a rule are not very numerous in the groups of the Gondwána system, only in those groups where marine animals occur together with the plants or are contained in beds intercalated with the plant bed, the animal remains are more numerous.

I shall proceed in a biological order.

ANNULOIDA.

Echinodermata.*

Very rare.

Ophiura,† sp.

1879. Madras coast Flora, *l. c.*, p. 224.

Upper Gondwánas: Sripermatur group, South Kistna district.

ANNULOSA.

Crustacea.

Candona‡ *kotaensis*,§ Jones.

1862. Monograph of fossil *Estheriæ*, Palæontographical Soc., p. 127.

Upper Gondwánas: Kota beds, near Sironcha, middle Godávari.

Estheria‖ *kotaensis*, Jones.

1862. Ib., *l. c.*, p. 81.

Upper Gondwánas: group and locality the same.

* Echinos (gr.) = a spine; derma (gr.) = skin.

† Ophis (gr.) = snake; ura (gr.) = taíl, referring to the thinness of the arms.

‡ Proper name. § Locality Kota. ‖ Proper name.

Estheria mangaliensis,* Jones.

1862. Palæontogr. Society, Monogr. fossil *Estheriæ*, p. 76, Pl. II, 16-23.

Lower Gondwánas: (?) Kámthi group at Mángli, South of Nágpur.

This species was also identified by Prof. Geinitz from rhätic beds of the Argentine Republic.

Besides this larger form, there also occurs another smaller kind, which appears to be identical with a similar form in the Panchet rocks of the Raniganj coalfield, near Assensole.

Eryon† comp. *barrowensis*,‡ McCoy.

1877. Feistmantel, Rec. Geol. Survey of India, Vol. X, p. 193, et fig. 8.

Upper Gondwánas: Sripermatur group at Vemáveram, South Kistna district.

Class MOLLUSCA.§

Representatives of this class have hitherto been found in the upper Gondwánas only.

Order Brachiopoda.‖

Many *Brachiopoda* occur in the Umia group in Kach, in beds intercalated with the plant beds, while there is a form of a *Rhynchonella* in the *Sripermatur* group in the same beds with the plants.

Order Lamellibranchiata.¶

These occur in the *Sripermatur* group at Ragavapuram (South Godávari district), Vemáveram (South Kistna district) and of the Sripermatur area; most of them are of the same genera (and apparently also of the same species) by which and especially by the common occurrence of the same *Ammonites* the groups of these three districts may safely be correlated, even without reference to the fact that the Floras also are of the same character.

In the Umia group of Kach there are many *Lamellibranchiata* (bivalves) of which I shall mention especially two, as they also occur in the Tripetty sandstones on the S. E. Coast (South Godávari), which represent the Umia group.

* Locality Mángli.
† Mytholog. name.
‡ Locality Barrow.
§ Mollis (lat.) = soft, tender.
‖ Brachion (gr.) = an arm; pus (gr.) = a foot.
¶ Lamella (lat.) branchia (gr.) = gill (having lamellar gills).

*Trigonia** *Smeei*,† Sow.

1841. Trans. Geol. Soc. Lond., Vol. V, pp. 715, 716, Pl. LXI, fig. 5.

Upper Gondwánas : Umia group at Bururia and other places in Kach ; and at Innaparazpolliam, about 30 miles North West of Coconada.

Trigonia ventricosa,‡ Kraus.

1850. Kraus N. Act. Acad. Leop. Car., Vol. XXII, Pt. 2, pp. 456-458, Pl. 49, fig. 2.

1879. Manual Geology of India, p. 261, fig.

Upper Gondwánas : Umia group same localities.

There are other bivalves figured and described by Sowerby (*l. c.*), from Kach, but it is not necessary to enumerate them here, as all the bivalves as well as the *Gasteropda* (of which there are however not many) have still to be properly worked out and described.

Cephalopoda.§

The *Cephalopoda* of the Jurassic rocks of Kach have already been figured and described in Ser. IX of the Palæontologia indica, and I shall therefore not quote them here.

I mention this order only on account of one form of *Ammonites*, which is common to the shales at Raguvapuram (South Godávri district) the shales at Vemáveram and other places (South Kistna district) and the Sripermatur area, and helps to correlate the beds of these three areas.

VERTEBRATA.‖

Pisces.

Remains of fishes are not uncommon in the upper Gondwánas, while in the lower Gondwánas they are extremely rare.

Ganoid fishes.

The only remains of fishes in the lower Gondwánas are scales of ganoid fishes. They were first mentioned by the late Rev. Mr. Hislop.¶ One or two speeimens are amongst the collections of the Geological Survey of India.

In the upper Gondwánas fishes are more numerous ; they were partly described in the Quart. Journ. Geol. Soc. London, and partly only recently in the Palæontologia Indica.

* Treis (gr.) = three ; gonia (gr.) = angle = the triangled shell.
† Proper name.
‡ Ventricosus (lat.) = blown up.
§ Kephale (gr.) = the head ; pous (gr.) = the foot.
‖ Vertebra = a backbone.
¶ Quar. Jour. Geolog. Soc. Lond., Vol. XVII, p. 347.

They are all from the limestones at Kota, near Sironcha, Central Provinces (Kota Maléri beds). The following have hitherto been described.

Dapedius egertoni,†* Sykes.

Quart. Journ. Geol. Soc. Lond., Vol. IX, p. 352.
Aechmodus ... Egerton, ib., Vol. X, p. 367.
Egerton, Pal. ind. Ser., IV, 2, pp. 6-8, Pl. II, 3-5.

Lepidotus‡ breviceps,§ Egert.

Quart. Journ. Geol. Soc., Vol. X, p. 371, Pl. XII.

L. calcaratus,‖ Egert.

Pal. ind., *l. c.*, p. 3, Pl. III, 2-3.

L. deccanensis,¶ Egert.

Quart. Journ. Geol. Soc., Vol. VII, p. 272, Pl. XV.

*L. longiceps,*** Egert.

Ibid., Vol. X, p. 371, Pl. XII.

L. pachylepis,†† Egert.

Pal. ind., *l. c.*, p. 2, Pl. I.

Tetragonolepis‡‡ analis,§§ Egert.

Ibid., p. 5, Pl. II, fig. 1.

T. oldhami, Egert.

Ibid., p. 3, Pl. II, fig. 1.

T. rugosus,‖‖ Egert.

Ibid., p. 6, Pl. II, fig. 2.

* Dapedon (gr.) = a pavement.
† Proper name.
‡ Lepidotos (gr.) = scaly.
§ Shortheaded.
‖ Calcar (lat.) = a spur.
¶ Deccan.
** Longheaded.
†† With thick scales.
‡‡ With four-angled scales.
§§ Anal.
‖‖ Rugged.

*Dipnoi.**

This order includes the interesting genus *Ceratodus*,† which is not uncommon in the red clays of the (Kota) Maléri group at Maléri, in the middle Godávari basin, South of Chanda.

They were originally described and figured by the late Dr. Oldham in the Memoirs of the Geological Survey of India, Vol. I, pp. 300-307. Four species were then distinguished, *viz.*, *Cerat. hislopianus*, *Cerat. hunterianus*, *Cerat. oblongus* and *Cerat. virapa*. These Ceratodus-teeth were recently re-examined by Prof. Miall and discussed and figured in the Palæontologia Indica, Ser. IV, Pt. 2, pp. 9-17, Pl. IV. He however adopts three species only, classing *C. oblongus* as a synonym of *C. virapa*.

AMPHIBIA.‡

Labyrinthodontia.§

Brachyops‖ *laticeps*,¶ Ow.

1855. Owen, Quart. Journ. Geol. Soc. Lond., Vol. IX, p. 37, Pl. II.
1879. Manual, Geol. India, Vol. I, p. 10, figure.

Lower Gondwánas: Shales at Mángli.

*Gonioglyptus*** *longirostris*,†† Huxley.

1865. Huxley, Pal. ind. Ser. IV, I, pp. 3-6, Pl. VI.
1879. Lydekker, ib. Ser., IV, 3, p. 17, Pl. III, pp. 14-15.

Lower Gondwánas: *Panchet group*, near Deoli South West of Assensole, on the Damuda river, Raniganj coalfield.

Pachygonia‡‡ *incurvata*,§§ Huxl.

1865. Huxley, *l. c*, pp. 6-7, figs. 1-2.
1879. Lydekker, *l. c.*, pp. 18-19, Pl. III, figs. 12-13.

Lower Gondwánas: Locality same as above.

Archegosaurus,‖‖ (?) sp. ?

1864. Journ. As. Soc. Beng., Vol. XXXIII, pp. 336, 442.
1872. Dr. Oldham Rec. Geol. Surv. India, Vol. IV, p. 70.

* Dis (gr.) twice; pnoe (gr.) = breadth.
† Keras (gr.) horn; odous (gr.) = tooth.
‡ Amphi (gr.) = both; bios (gr.) = life.
§ Labyrinthos (gr.) = a labyrinth; odous (gr.) = tooth, referring to the structure of the teeth.
‖ Short-faced.
¶ Broadheaded.
** Gonia (gr.) = angle (of the mandible); glyptos (gr.) = sculpture.
†† With a long snout.
‡‡ Pachys (gr.) = thick; gonia (gr.) = an angle.
§§ Incurved.
‖‖ The ancient Saurian.

1873. H. B. Medlicott, Mem. G. S. Ind., Vol. X, p. 159.
1875. H. F. Blanford, Qu. J. G. Soc. London, Vol. XXXI, p. 522.
1879. Feistmantel, Rec. G. S. India, Vol. XII, pp. 76, 78.
1880. Lydekker, J. A. S. Bengal, Vol. XLIX, p. 12.

A skull of a Labyrinthodont animal is referred to this genus, although it appears that it was never thoroughly examined or figured.

Lower Gondwánas : Bijori horizon (= Raniganj group) of the Sátpura basin, near Bijori in the upper Denwa valley ; the name of the horizon is taken from this locality.

Reptilia.*

These are more numerously represented.

Lacertilia.

Hyperodapedon,† sp. Huxley.

1868. Huxley, Qu. J. Geol. Soc. Lond., Vol. XXV, figure, pp. 138-151.
1879. Manual, Geology, India, p. 153, and figure.
1880. Lydekker, J. A. S. B., p. 14.
1880. Feistmantel, Rec. Geol. Soc. India, Vol. XII, Pt. 3, p. 189.

Upper Gondwánas : (Kota) Maléri beds, at Maléri, Middle Godávari basin, C. Prov. ; at Tiki in the South Rewah basin.

Crocodilia.‡

Parasuchus,§ (*hislopi* MSS. Huxley).

1870 and 1875. Huxley, Qu. J. G. Soc. London, Vols. XXVI, p. 49, XXXI, p. 423.
1870. Lydekker, Pal. ind. Ser. IV, 3, p. 35
1880. Feistmantel, R. G. S. India, Vol. XIII, p. 189.

Upper Gondwánas : Same as preceding.

Parasuchian crocodile ; Scute.

1879. Lydekker, Pal. ind. Ser. IV, 3, p. 30, Pl VI, fig. 8.

Upper Gondwánas : Denwa group, Denwa river near Jhirpa, N. E. of Pachmari.

Parasuchian crocodile, Vertebra.

1877. Lydekker, R. G. S. I., Vol. X, p. 34.
1870. Lydekker, Pal. ind. Ser. IV, 3, p. 31.

Upper Gondwánas : Chari group, near Chari in Kach.

* Repto (lat) = to crawl.

† Hyperos (gr.) = a pestle, club; dapedon (gr.) = a pavement, referring to the arrangement of the teeth.

‡ Crocodiles.

§ Para (gr.) = prefix, expressing a comparison; suchos = a local name of the crocodile in Egypt.

Sauropterygia.

Plesiosaurus indicus*, †Lyd.

1879. Wynne, Geology of Kach; Mem. Geol. Survey of India, Vol. IX, p. 129, (mentions the jaw.)

1879. Lydekker, Pal. ind. Ser., IV, 3, p. 28. Pl. VI, fig. 1.

Upper Gondwánas: Umia group, near Bururia, Kach.

Anomodontia.

Dicynodon‡ *orientalis*,§ Huxley.

1865. Huxley, Pal. ind. Ser., IV, 1, pp. 8-11, Pls. I—V.

1879. Lydekker, ib. Ser. IV, 3, pp. 1-17, Pl. I, II, III, 1-11.

Lower Gondwánas: Panchet group, near Deoli, Damuda river, S. W. Assensole, Raniganj coalfield.

Deinosauria.

Ankistrodon‖ *indicus*, Huxley.

1865. Huxley, *l. c.*, pp. 11-12, figure on p. 12.

1879. Lydekker, *l. c.*, p. 17.

Lower Gondwánas: Same as preceding.

Concluding remarks.

This sketch being merely written to convey an idea as to the amount and character of the fossils hitherto known from the interesting Gondwána system in India, without the intention of any extensive discussion of its age, the correlation of the groups, or of all the views hitherto proposed and disputed, I shall conclude with a few remarks regarding the chief peculiarities of the fossils of the system.

1. Four of the genera of plants in the lower Gondwánas are also met with in the lower coalmeasures of Australia (*viz.* New South Wales), these are:—*Phyllotheca*, *Vertebraria*, *Glossopteris* and *Nöggerathiopsis*, they are, however, more developed in the upper coalmeasures (New Castle-beds), at the top of the palæozoic epoch, where we also find the first appearance of *Gangamopteris*. By means of these four genera our Damuda Series were formerly correlated with the Australian beds. But while entirely admitting the fact of this common occurrence, we can now state, that *Phyllotheca* on the other hand is very abundant in the Jurassic beds of

* Plesios (gr.) = near; Sauros; (gr.) = a lizard.

† Indian.

‡ Dis (gr.) = twice; Kyon (gr.) = dog; odus (gr.) = a tooth.

§ Oriental.

‖ Ankistron (gr.) = a hook; odus (gr.) = a tooth.

Siberia, the Amur countries and Italy; *Vertebraria*, *Glossopteris* and *Nöggerathiopsis* pass into the upper Gondwánas in India; and *Nöggerathiopsis* has a very close relation in the Jura of the Altai, the Tunguska river and the Petschora country and *Gangamopteris* is in Australia chiefly developed in the Bacchus-marsh beds which are considered to be mesozoic.

2. On the other hand in the Gondwána system, both in the lower and upper portions, there are many forms, which have no representatives in the Australian coalmeasures, though related forms occur in the higher (meszoic) beds elsewhere.

Thus we have very abundantly in the Talchirs the genus *Gangamopteris*, which under similar circumstances occurs in the Bacchus-marsh beds (mesozoic) in Victoria.

In the Karharbári beds there is again abundantly represented *Gangamopteris;* and besides it *Neuropteridium* (single pinnate *Neuropteris* of the Trias) and *Voltzia* (permian, but especially Triassic).

In the Damuda Series there is *Schizoneura* (Trias-Rhätic) a *Cyathea* (jurassic) a *Dicksonia* (related to some jurassic forms) *Asplenium whitbyense* (jurassic) and another form, belonging with a species from the upper beds in Australia probably also to this type; there is a *Merianopteris* (Trias in Europe); there are forms of *Macrotæniopteris* (related with mesozoic forms, one is in the Wianamatta beds in Australia) and there are other *tæniopteroid* plants with mesozoic affinities;

Of *Cycadeaceæ* we have *Pterophyllum*, *Anomozamites* and *Glossozamites* which are predominantly (for the first named) or exclusively (for the two last named) mesozoic.

Of coniferous plants there is *Rhipidopsis* (of the Jura in the Petschora country N. Russia) one of the *Salisbureæ*, and *Cyclopitys*, of the Jura in Siberia, and *Voltzia* (predominantly Triassic).

There are also some seeds with mesozoic affinities.

In the Panchet division there is *Schizoneura*, *Pecopt. concinna* and *Cyclopt. pachyrhachis* which are Triassic and Rhätic.

3. The Upper Gondwána plants do not require any further explanation.

4. But there is, in Kach, the interesting case, that a Flora of middle jurassic type is intercalated with and overlaid by animals of uppermost jurassic age.

5. The animal remains of any importance from the lower Gondwánas, hitherto known, are fresh-water and land vertebrates (*Pisces*, *Batrachia* and *Reptilia*) the relations of which were discussed by Mr. Lydekker, in his above-mentioned paper in this Journal.

The animals of the Upper Gondwánas are somewhat more varied consisting both of land and fresh water animals and of marine animals.

The former are represented by interesting *fishes* and *Reptilia* which show various ranges, when compared with European relations.

The marine animals are on the whole jurassic, representing various groups, up to uppermost Jurassic.

With these few remarks I conclude my sketch of the Gondwána fossils ; my object will have been gained if I succeed in drawing general attention to these interesting remains but more especially that of those who are in charge of collieries or quarries and so induce them to be careful in looking out for specimens. I also desire to show to the scientific world, particularly of Europe, how much has already been accomplished, by the small body of officers employed in these areas, who have many a time to carry on their work under most unfavourable circumstances.

XIII.—*Additional note on the identification of the ancient diamond mines visited by Tavernier.*—*By* V. Ball, M. A., F. G. S.

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I return to this subject as since my last paper was published I have obtained some additional information on the subject, part of which is the direct result of the publication of that paper, and the remainder is in further illustration of the views put forward in it.

Raolconda.—By applying what seemed to be a legitimate arithmetical test to the figures given by Tavernier as indices of the position of this place, the conclusion was arrived at that it was to be identified with Rawduconda on the Tungabhadra river. The chief objection to this view was that we had no independent knowledge whatever of there ever having been diamond mines there, but since, as a matter of fact, nothing was known of the Geology, it seemed possible that diamond bearing rocks might occur there. As an alternative the only other place I could suggest was Ramulkota, to which indeed some of Tavernier's stages pointed, but, on the system of calculation adopted, this locality did not seem to fit so well. I did not venture to write on this subject without doing my best to obtain local information, but as it did not come, or rather as that which was received was more of the nature of speculation than actual fact, my paper was printed, and it has had the advantage of leading to the final settlement of the one doubtful point, namely, the position of Raolconda. As will presently be shown by a quotation from Rennell, which was not included in my last paper, this question was discussed and, as we now know, wrongly decided about 100 years ago.

I must here first record my thanks to Mr. Maurice, H. Wilkinson, Secretary to the Nizam in the Public Works Department, for having done